

## The genus *Maculinea* van Eecke, 1915 (Lepidoptera: Lycaenidae) from the East Palaearctic Region\*

Atuhiro SIBATANI<sup>1)</sup>, Toyohi SAIGUSA<sup>2)</sup> and Toshiya HIROWATARI<sup>3)</sup>

<sup>1)</sup>Kyoto Seika University, 137, Kinotô, Iwakura, Sakyô-ku, Kyôto 606, Japan.

<sup>2)</sup>Biological Laboratory, College of General Education, Kyushu University, 4-2-1, Ropponmatsu, Chûô-ku, Fukuoka 810, Japan.

<sup>3)</sup>Entomological Laboratory, College of Agriculture, University of Osaka Prefecture, Sakai, Osaka 593, Japan.

**Abstract** We revise the classification of taxa belonging to the genus *Maculinea* from the East Palaearctic Region. In this region, in addition to the well-known three species: *M. arion* (Linnaeus, 1758), *M. arionides* (Staudinger, 1887) and *M. teleius* (Bergsträsser, [1779] 1778-1780), two additional species occur: *M.alcon* ([Denis & Schiffermüller], 1775) (upper and middle Amur River, Primor'e, China Northeast/Manchuria and North Korea) and *M.kurentzovi* sp. nov. (upper and middle Amur River, Primor'e, China Northeast and North Korea). *Lycaena kondakovi* (Kurentzov, 1970) described from Primor'e is a composite species: the lectotype ♂ designated here represents an East-Asian subspecies of *M.alcon*, but its single paralectotype is a ♀ to be assigned to *M.kurentzovi* sp. nov. Only limited numbers of specimens have been known with *M.alcon kondakovi* from lowlands of "Far-Eastern" Russia and China Northeast, but in North Korea we found a conspicuous allied taxon *arirang* nov. (♀ unknown), which we treat here as a highland subspecies of *M.alcon* but which may actually represent a good species. Of *kurentzovi*, we have found a series of specimens which have so far been mostly confused with *M.teleius* in various collections. We treat *Glaucopsyche xiaheana* Murayama, 1991 from western Gansu as a subspecies of *M.arion* along with other subspecies from the central and western parts of China: *M.arion philidor* (Fruhstorfer, 1915) from the east end of the Qilian Range as well as Mongolia, the type locality, and *M.arion inferna* nom. nov., a replacement name for *Lycaena tatsienluica* (Oberthür, 1910) (praeoccupied) from Tibet, Sichuan and Qinghai. Because of the similarity of male genitalia and existence of intermediate forms, we regard *M.sinalcon* Murayama, 1992 described from Qinghai as a subspecies of *M.teleius* despite a few significant characteristics of the holotype. East continental Asia may be regarded as the headquarter of the genus *Maculinea*.

**Key words** Lycaenidae, *Maculinea*, genitalia, androconia, nature conservation, Russian Far East, Primor'e, Northern Korea, China Northeast, Tibet.

## Introduction

The genus *Maculinea* van Eecke, 1915 has recently attracted attention in conservation of butterflies. In Europe, five species have been recognized of this genus: *M.alcon* ([Denis & Schiffermüller], 1775) (type species of the genus), *M.rebeli* (Hirschke, 1904), *M.arion* (Linnaeus, 1758), *M.nausithous* (Bergsträsser, [1779] 1778-1780) and *M.teleius* (Bergsträsser, [1779] 1778-1780). They are believed to be among the most endangered species of butterflies in Europe (Heath, 1981), for which concept the final extinction of the last British colony of *M.arion* served as a paradigm (Thomas & Elmes, 1989; Morris & Thomas, 1991). Moreover, the larvae of every species known in Europe are adopted by a

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respectively unique species of *Myrmica* ants (Thomas & Elmes, 1989).

At the other end of the Palaearctic Region, the situation is not quite so simple. The two species occurring in Japan, *M. teleius* and *M. arionides* (Staudinger, 1887) have life histories which closely parallel those of the European taxa (Yamaguchi, 1988). At the moment they are not particularly ranked among the highly endangered species in the Red Data Book Japan (Kankyôtyô, 1991). In the Asian Continent, besides the so-far well known three species including *M. arion*, *arionides* and *teleius*, three other species have so far been recorded. Of these, two are common with Europe: *alcon* from China Northeast or Manchuria (Sibatani, 1940; Seok, 1973) and *nausithous* (= *arcas* Rottenburg, 1775) from northern Korea (Seok, 1936, 1973; Seok & Asahina, 1940). However, it will be shown in this paper that the record of *nausithous* is based on a misidentification of *M. teleius*. Besides, a separate species to be placed to *Maculinea*: *Lycaena kondakovi* Kurentzov, 1970, has been described from Primor'e or the Maritime Province (formerly often called Ussuri) of the Russian "Far East". Little is known of the early stages of these five continental taxa, but apparently they have been regarded as endangered neither in South Korea (Kim & Hon, 1990; Shin, 1990) nor in the "Far East" of Russia USSR (Belyaev *et al.*, 1989).

In this paper we revise the classification of East-Asian *Maculinea*. The main area of our interest is Primor'e and North Korea, and we wish to analyse existing data and literature of these regions in comparison with those of Japan and also of China Northeast (Manchuria) as well as the middle and upper regions of Amur River, whenever possible. We designate the lectotype of *kondakovi* (♂), which has proved to be the East Asian lowland subspecies of *alcon* (or *rebeli* as it might be). However, the only paralectotype (♀) of *kondakovi* represents a new species which we describe here from northern part of Korean Peninsula, Primor'e, China Northeast (Manchuria) and along the upper region of the Amur in Russia. We also describe a new species-group taxon related to *alcon* from North Korea: *arirang* nov. based on 6 ♂ from two localities (♀ unknown). This taxon may very well represent a new species, but we tentatively treat it here as the East Asian highland subspecies of *alcon*.

Although their distribution lies outside the area of our immediate interest, there are two recently described taxa from central China: *Glaucopsyche xiaheana* Murayama, 1991 from Gansu and *M. sinalcon* Murayama, 1992 from Qinghai. Of these, the former should be transferred to *Maculinea*. We treat them here as a high-altitude subspecies of *M. arion*, and *M. teleius*, respectively, from central China. Moreover, the former taxon is very similar to *Maculinea arion inferna* nom. nov., replacing the praeoccupied name *Lycaena arion tatsienluica* Oberthür, 1910 from west China (former Tibet), which may eventually prove to be a subjective synonym of *Glaucopsyche xiaheana* Murayama, 1991. As to *sinalcon*, because of the presence of intermediate forms, we place it to *M. teleius* which has only recently been recorded from central China (Wang *et al.*, 1990), although the holotype shows a few significant differences from the typical *teleius*.

Bálint (1989a, 1990) has recently treated *Maculinea* van Eecke, 1915 as a subgenus of *Glaucopsyche* Scudder, 1872 on the ground that genitalia of both taxa are indistinguishable. However, the characteristic life history including the association with ants, so peculiar to all the European and Japanese taxa of *Maculinea* may be held as a sufficient ground for their generic separation. Although we give an in-depth description of the male genitalia of the genus *Maculinea*, we have not established its generic difference from the related genus-group taxa. Apparently, however, the good separation of bilateral socii with a deep

median groove and conspicuous proximal swelling of phallus in *Maculinea*, including *xiaheana*, might serve as distinctive characters of *Maculinea* from *Glaucopsyche*. Our conventional idea is also supported by a recent analysis of phylogeny of European "Blues" by Lelièvre (1992).

Further, mainly for the entirely different biotopes in which the butterflies are found, Bálint (1990) has treated *M. cyanecula* (Eversmann, 1848) from Caucasus to Mongolia as a distinct species from *M. arion* of Europe, to which taxon the former had always been placed as subspecies. This action, however, leaves the East Asian "subspecies" of *M. arion*, *i.e.* *ussuriensis* (Sheljuzhko, 1928) in an ambiguous position, so that we continue to be conservative in the present paper about this subject.

We illustrate adults of relevant taxa in Figs 1-28. Below we give a key to all the *Maculinea* species and a few relevant subspecies, but not to all the subspecies because we do not cover the entire range of subspecies for any of these species.

#### Abbreviations

##### Collections :

AS—Collection of A. Sibatani, Kyoto.

IBP—Kurentzov Collection housed in the Institute of Biology and Pedology, Far East Branch, Russian Academy of Sciences, Vladivostok.

IS—Sugitani Collection housed at Kyushu University, Fukuoka.

ISEZ—Instytut Systematiki i Ewolucji Zwierząt, Polska Akademia Nauk, Kraków.

KS—Collection of Kinoshita S., Osaka.

KUB—Kyushu University, Biological Laboratory, Fukuoka.

MAK—Museum Alexander Koenig, Bonn.

MS—Collection of S. Murayma, Osaka.

OMNH—Osaka Museum of Natural History, Osaka.

UOP—Entomological Laboratory, University of Osaka Prefecture, Sakai, Osaka.

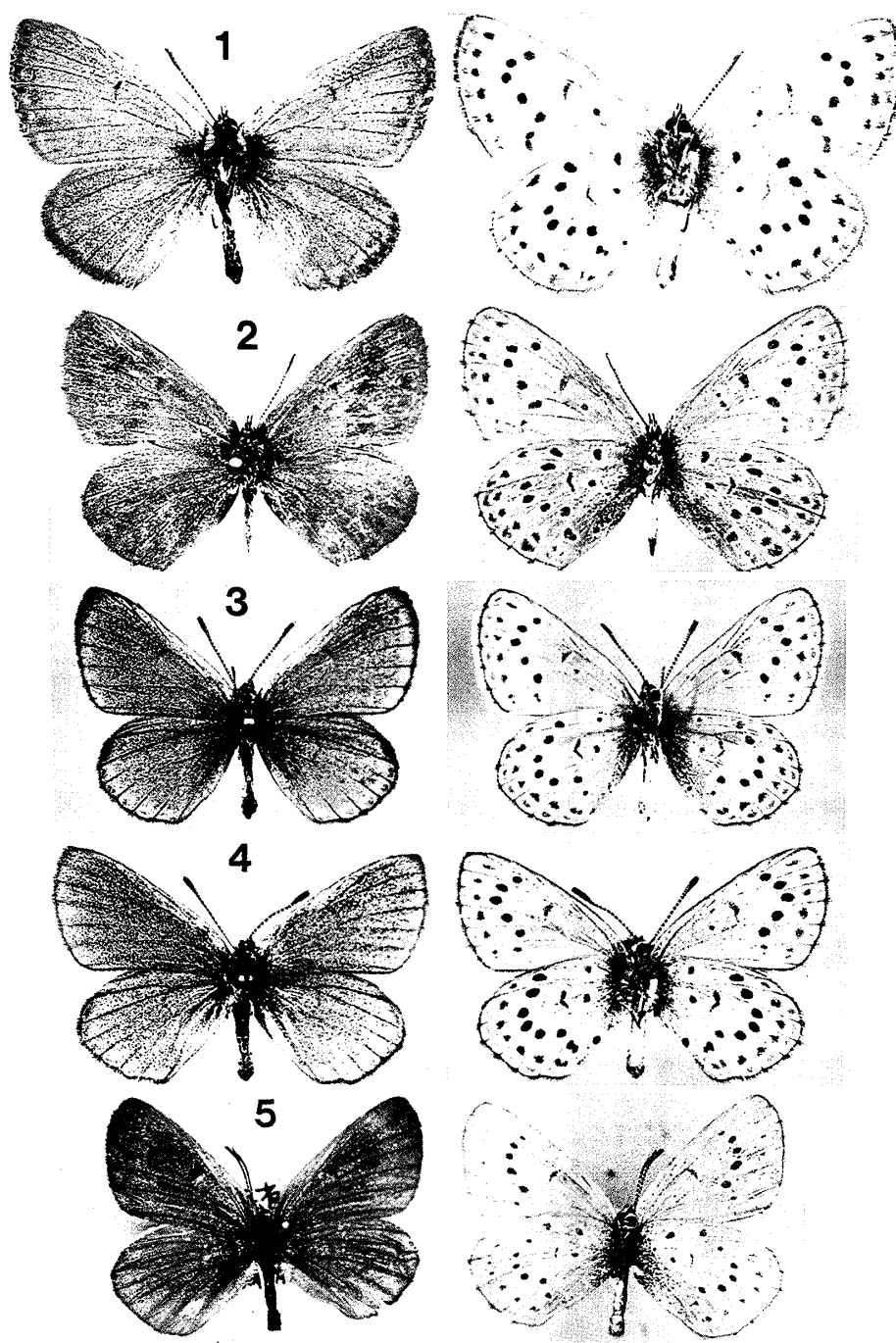
WE—Collection of Wolfgang Eckweiler, Frankfurt am Main.

##### Wings :

FW—forewing, HW—hindwing, FL—forewing length.

#### Key to the East Asian species (with a few relevant subspecies) of the genus *Maculinea* van Eecke, 1915, including a taxon from central China and others exclusively from Europe

- 1 Ventral surface postmedian spot in  $CuA_1$ - $CuA_2$  on both wings shifted basad in comparison with those in  $M_3$ - $CuA_1$  and  $CuA_2$ -1A+2A (Fig. 29A) ..... 2  
 —Ventral surface postmedian spot in  $CuA_1$ - $CuA_2$  on both wings not markedly shifted based in comparison with the ones in  $M_3$ - $CuA_1$  and  $CuA_2$ -1A+2A (Fig. 29B)  
     ..... *M. teleius* (except subspp. *sinalcon* and *ogumae*)
- 2 Ventral surface not very dark brown and with series of submarginal spots ..... 3  
 —Ventral surface very dark brown without series of submarginal spots; from only Europe ..... *M. nausithous*
- 3 Ventral HW at least basally suffused with bluish or greenish scales ..... 4  
 —Ventral HW nowhere suffused with bluish scales ..... 5
- 4 Ventral ground colour brownish, never whitish; ventral FW spots in spaces  $M_1$ - $CuA_2$  round and not elongated ..... *M. arion*



Figs 1-28. Taxa of *Maculinea* from the continental part of the East Palaearctic Region (1.4×natural size). Numbered pictures on the left hand side represent the dorsal surface, the ventral surface of the cognate specimens is shown to their right, but not numbered.

Figs 1-4. *M.alcon* ([Denis & Schiffermüller], 1775), subspecies. 1-2. *M.alcon kondakovi* (Kurentzov, 1970). 1: ♂, lectotype of *Lycaena kondakovi* Kurentzov, 1970, Gornotayozhnaya, Primor'e, Russia. 2: ♀, Chita, the upper Amur River region. 3-4. *M.alcon arirang* ssp. nov., N Korea. 3: ♂, holotype, near Taep'yo, south of Paegdu-san, Ryanggang-Do. 4: ♂, paratype, near Samjiyon, Rhyanggang-Do.

Fig. 5. *M.teleius sinalcon* Murayama, 1992, comb. nov., ♂, holotype, "Huaunzhou" [= Huangzhong], Qinghai, China.

- Ventral ground colour generally whitish but sometimes with brownish tinge; ventral FW spots in spaces  $M_1$ - $CuA_2$  prominently elongated ..... *M. arionides*
- 5 Ventral FW postmedian (often double) spot in  $CuA_2$ -1A+2A smaller and more weakly marked than other spots of the same series. Androconia present ..... 6
- Ventral FW postmedian double spot in  $CuA_2$ -1A+2A usually as strongly marked as other spots of the same series. Androconia absent ..... *M. kurentzovi* sp. nov.
- 6 Male dorsal surface ground colour blue. Ventral FW postmedian spots in  $M_2$ - $CuA_2$  in an oblique straight line (Fig. 29C) ..... 7
- Male dorsal surface ground colour brown with very little blue basal suffusion. Ventral FW postmedian spots in  $M_2$ - $CuA_2$  not in a straight line but in a costad-concave curve (Fig. 29D) ..... *M. teleius sinalcon*
- 7 Ventral surface brown; male dorsal surface blue without dark postmedian spots ..... *M.alcon* as well as *rebeli* from Europe
- Ventral surface whitish grey-brown; male dorsal surface blue usually with dark postmedian spots ..... *M. teleius ogumae*

### Evaluation of characters for taxonomy of the genus *Maculinea*

*Androconia*. There seems to be no systematic work done on the androconium or battle-dore scale of the genus *Maculinea*. Those of *M. arionides* and *M. teleius* have been illustrated by Kawazoé and Wakabayashi (1976). We have found that not only morphology of androconia but also their frequency relative to ordinary scales may occasionally serve as good characters of individual taxa. Table 1 includes empirical test of duplicating the frequency count (*M.alconalcon*) by repeated sampling from the same position, from different positions of the same wing surface, and from the corresponding position of the opposite wing, yielding comparable figures for the frequency of androconia, thus demonstrating a good reproducibility of the frequency count. However, the variability among individual specimens of both frequency and morphology of androconia and the latter among the scales found in a single sample of scales from a specimen, sometimes makes it difficult for us to solely depend on them for taxonomic criteria. Table 1, which includes some European taxa as well, depicts the relative frequency of androconia, illustrating the following general trend. The frequency of androconia relative to the ordinary pigmented as well as blue metallic scales varies in different taxa, ranging from a very high value in *M.alcon* (s. str.) to zero in *M. kurentzovi* sp. nov. Generally speaking, *M.alcon* provides examples in which androconia are much more frequent than the ordinary scales including either or both of the metallic blue and dark pigmented ones. In many taxa and specimens, however, androconia are less numerous than the ordinary scales, while the latter comprises almost the blue scales alone. When blue scales are scarce, however, androconia may be found either at a very low frequencies (*M. teleius euphemia*) or at a high one on the background almost exclusively of the black scales (*M. teleius sinalcon*). Thus there is no correlation between the frequency of androconia and that of the blue scales even in one species or at least species group. Finally, in *M. kurentzovi*, in spite of the presence of blue scales, no androconia could be found in all of the 8 specimens examined.

Morphology of androconia (Fig. 31) largely parallels the grouping based on the androconial frequency. Our observations are summarized in Table 2, where the shape and the number of longitudinal ribs are listed as characters useful in taxonomy. However, individual variation is sometimes enormous, and some specimens of one taxon may exhibit characters

Table 1. Relative frequency of androconia in different taxa of *Maculinea*.

Taxon		Number of scales counted	Relative frequencies (%)				
			Androconia	Ordinary scales		<i>a/b</i>	<i>b/c</i>
				Metallic blue***	Black		
			<i>a</i>	<i>b</i>	<i>c</i>		
<i>M.alconalcon</i>	Ex. 1	57	74	17	9	4.4	1.9
	1	85	78	13	9	6.0	1.4
	1*	75	75	20	5	3.8	4.0
	1**	287	77	16	7	4.8	2.3
<i>M. a. kondakovi</i>	lectotype	129	50	25	25	2.0	1.0
<i>M. a. arirang</i> ssp. nov.	Ex. 1						
	holotype	135	36	27	37	1.3	0.7
	topotype	134	36	24	40	1.5	0.6
	(Taechongdan)	Ex. 3	48	58	13	2.0	2.2
	(")	Ex. 4	104	68	19	3	3.6
	(")	Ex. 5	118	52	22	26	2.4
<i>M. rebeli</i>	(")	Ex. 6	64	45	17	38	2.6
	(Poland)	Ex. 1	138	56	22	22	2.5
	? (Italy)	Ex. 2	28	36	28	36	1.3
<i>M. arion arion</i>	(Poland)	Ex. 1	72	46	39	15	1.2
		1	92	43	25	32	1.7
	(Slovakia)	Ex. 2	28	64	29	7	2.2
	(Poland)	Ex. 3	137	48	25	27	1.9
	(Switzerland)	Ex. 4	148	44	19	37	2.3
<i>M. a. xiaheana</i> (Gansu)	(Italy)	Ex. 5	90	47	21	32	2.2
	Ex. 1	58	57	33	10	1.7	3.3
	Ex. 2	57	32	56	12	0.6	4.7
	Ex. 3	66	56	20	24	2.8	0.8
	Ex. 4	42	33	17	50	1.9	0.3
<i>M. a. ussuriensis</i>	(Korea)	Ex. 1	60	53	22	25	2.4
	(Korea)	Ex. 2	88	46	40	14	1.2
<i>M. arionides arionides</i> (Primor'e)	Ex. 1	67	33	40	27	0.8	1.5
	Ex. 2	143	32	35	33	0.9	1.1
<i>M. a. takamukui</i>	(Japan)	66	52	33	15	1.6	2.2
<i>M. nausithous</i>	(Poland)	Ex. 1	64	52	31	17	1.7
		Ex. 2	52	44	16	40	2.8
<i>M. kurentzovi</i> sp. nov.	(Korea)	Ex. 1	71	0	10	90	0
	(Korea)	Ex. 2	99	0	1	99	0
	(Korea)	Ex. 3	148	0	6	94	0
	(Korea)	Ex. 4	83	0	6	94	0
	(Korea)	Ex. 5	84	0	27	73	0
	(Korea)	Ex. 6	99	0	12	88	0
	(Korea) holotype	Ex. 7	57	0	9	91	0
	(Chita)	Ex. 8	70	0	17	83	0
	(Sungari)	Ex. 9	115	0	3	7	0
<i>M. teleius teleius</i>	(Poland)	106	39	30	31	1.3	1.0
<i>M. t. euphemia</i>	(Korea)	Ex. 1	29	10	0	90	—
	(Korea)	Ex. 2	28	64	29	7	2.2
	(Primor'e)	Ex. 3	54	48	17	35	2.8
<i>M. t. sinalcon</i>	holotype	49	53	2	45	26.5	0.04
<i>M. t. kazamoto</i>	(Japan)	40	30	48	22	0.63	2.2
<i>M. t. ogumae</i>	(Hokkaido)	141	32	52	16	0.62	3.3

Unless stated otherwise, all scale samples were taken from position below the cell end in space between CuA<sub>2</sub> and 1A+2A on the dorsal surface of the right FW. Separate samples from the left FW or from the cell of the right wing were also tested (see below):

\* Sample was taken from the corresponding position of the left wing.

\*\* Samples from the cell of the right wing.

\*\*\* This includes a few light-pigmented scales.

common in certain other taxa.

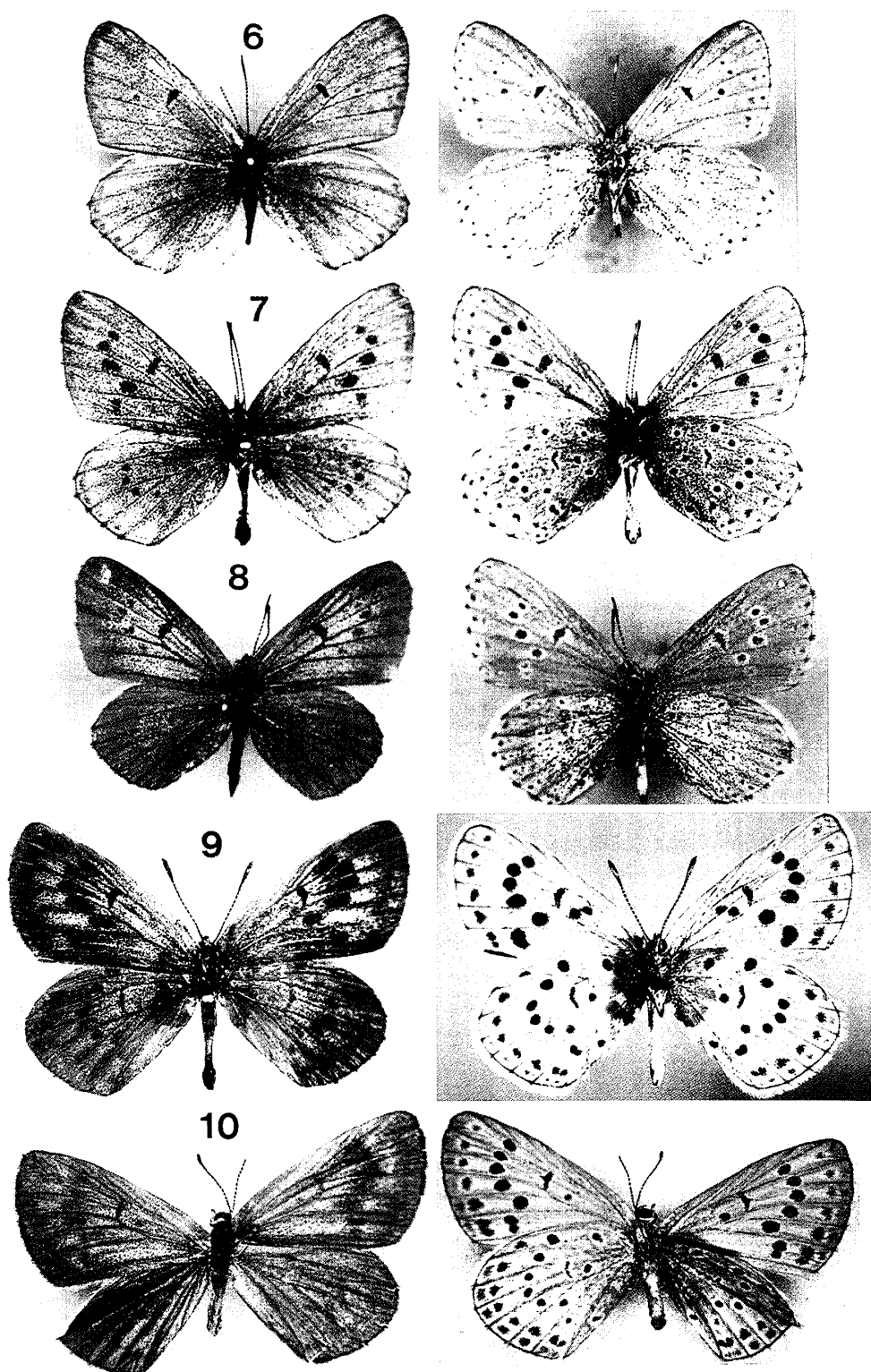
Affinity deduced from the androconial characteristics are largely congruous with that deduced from genitalia (see below).

*Male genitalia.* We have examined the male genitalia of all the known species of *Maculinea*, but not those of related genera. We therefore give general genitalic characters of the genus without reference to the related genus-group taxa.

General characters of the genus *Maculinea*: Ring almost perpendicular to body axis or slightly inclined caudad, with its cephalic margin slightly or distinctly expanded at or above the middle level; vinculum slender, without saccus on its ventral half, much dilated dorsad towards tegumen on its dorsal half. Tegumen completely fused with vinculum, much narrowed dorsally, moderately expanded ventrocaudally into a pair of lateral processes. Socius large, densely setose distally, united with tegumen dorsally, more or less distinctly separated from tegumen near the bases of falces<sup>1</sup> by membranous areas, and in lateral aspect angulately protruded caudad. Falx moderately long, completely united proximally with socius, horizontal, not drooping ventrad below the level of ventral margin of socius, more or less compressed laterally on its distal half, with its tip rather rounded and not exceeding caudad beyond socius. Valva lamellate, almost parallel-sided or dilated distad, broadly sclerotized and densely long-haired on both mesal and lateral surfaces, usually angulate ventrodistally, and bearing an almost straight dorsodistal hook (ampulla) of various lengths, which is often serrate or denticulate outwardly; sacculus fused with stalk of juxta. Juxta Y-shaped with a short or moderately long stalk or sometimes almost V-shaped, its arms slender and sparsely hairy. Anellus long-haired. Phallus rather long, slender to very thick; subzonal portion of phallus long, proximally swollen and ending in a pair of tubercles which surround base of bulbus ejaculatorius, so that the tubercles have a function of coecum penis; suprazonal portion short, aedoeagus divided into a dorsal and a ventral sclerites on suprazonal portion by lateral desclerotizations, the dorsal sclerite indistinctly incised laterally at its proximal half, well sclerotized, distinctly bordered, and parallel-sided on distal half, laterodistal corner of which is continuous to a slender band-like lateral sclerite on vesica; the ventral sclerite of aedoeagus more or less desclerotized proximally at lateral margins, and bearing distally Chapman's process of various lengths; vesica 1/2-2/3 the length of phallus, bearing a pair of weakly sclerotized and distally pointed ventrodistal lobes and a pair of band-like lateral sclerites continuing from dorsal sclerites of aedoeagus, adorned with a dorsal and a ventral groups of cornuti represented by thick spines which direct themselves proximad (when vesica is everted) and are arranged in longitudinal rows

On the basis of male genitalic morphology, the genus *Maculinea* may be divided into three groups: *alcon* group (*alcon* and *rebeli*), *arion* group (*arion* and *arionides*), and *teleius* group (*teleius*, *kurentzovi* sp. nov., and *nausithous*), and the last group further into *nausithous* subgroup (by itself) and the *teleius* subgroup including *kurentzovi*. Their main features

<sup>1</sup> We use the term falx/falces according to Saigusa (1993) instead of the brachium. The former in Lycaenidae (s. lato) and the latter in some nymphalid subfamilies including Satyrinae (s. str.) are structures derived from gnathos along independent pathways of transformation, so that they are not homologous and hence should not be called by the same terminology (Saigusa, 1993: 5, footnote 1).

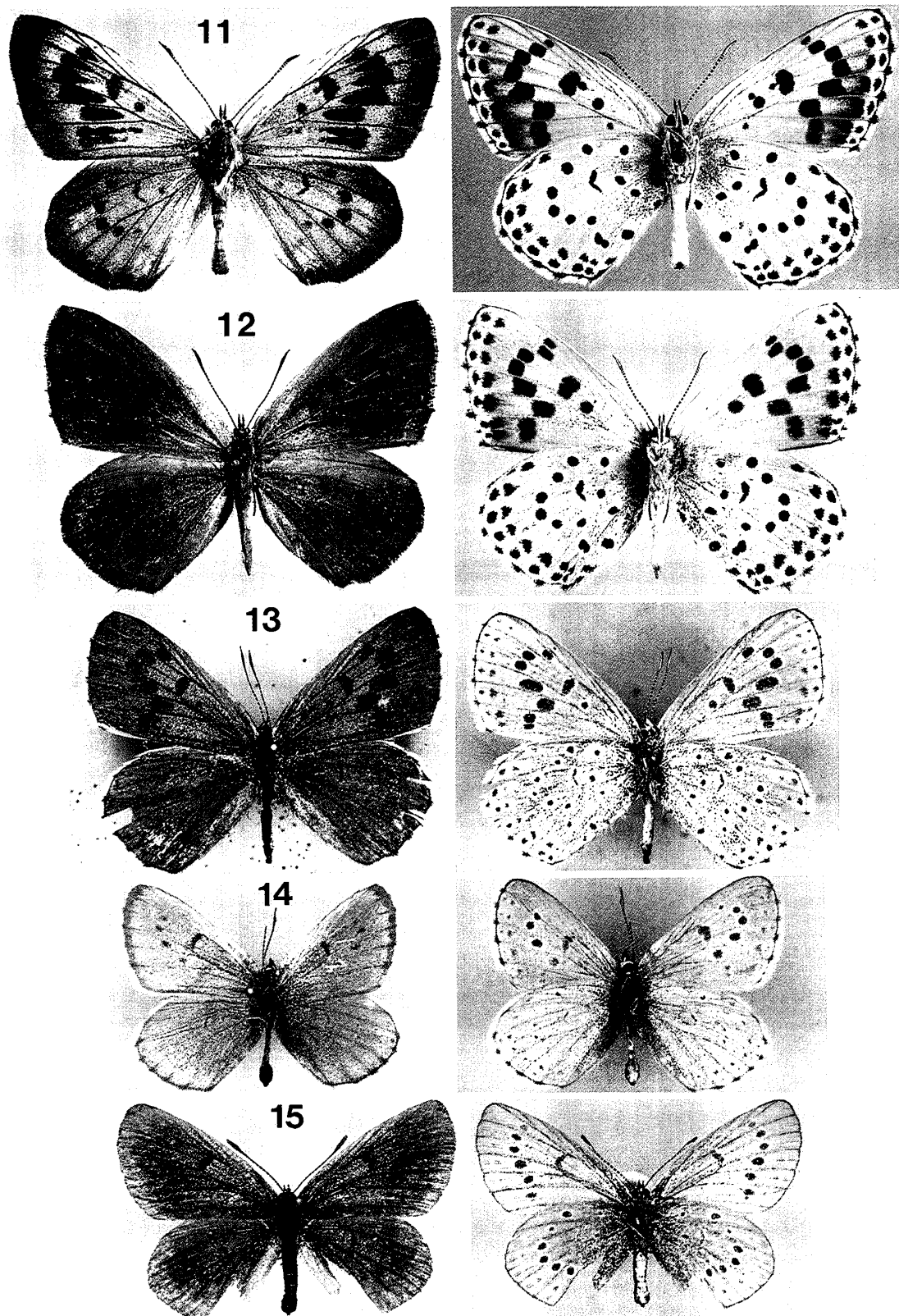


Figs 6-8 (see also Fig. 14). *M. arion xiaheana* (Murayama, 1991), Xiahe, Gansu, China. 6: ♂, holotype. 7: ♂. 8: ♀.

Figs 9-10 (see also Figs 18-24). *M. kurentzovi* sp. nov. 9: ♂, holotype, Handaeri, Ryanggang-Do, N Korea. 10: ♀, paralectotype of *Lycaena kondakovi* Kurentzov, 1970, Partizanskaya River, Primor'e, Russia.

Figs 11-14 (see also Figs 25-28). *M. arion* (Linnaeus, 1758), subspecies. 11-12. *M. arion ussuriensis* (Sheljuzhko, 1928), Hoeryong, Hamgyongbuk-Do, N Korea. 11: ♂.





12: ♀. 13. *M. arion inferna* nom. nov., ♀, "Huanzhou" [= Huangzhong], Qinghai, China. 14. *M. arion xiaheana* (Murayama, 1991), ♂, Xiahe, Gansu, China (see also Figs 6-8).

Fig. 15. *M. teleius euphemia* (Staudinger, 1887), ♂, near Samjiyon, N Korea, a specimen with only faintly marked submarginal spots.

Table 2. Androconial morphology of *Maculinea* species and its variation.

Taxon	Length	Tip				No. of ribs	
		round- ish	angu- lar	dilat- ed	taper- ing	* mean	s.d.
<i>M.alconalcon</i>	1	1	0	1	0	13.4	1.34
<i>M. a. kondakovi</i>	1	1	0	0	0	13.8	0.84
<i>M. a. arirang</i> ssp. nov.	1	1	0	0	0	(7) 15.0	1.73
	0	1	0	0	0	(6) 15.3	1.72
	1	1	0	1	0	14.4	1.22
	0	1	0	1	0	14.2	0.83
	1	1	0	0	0	15.4	0.89
	1	1	0	01	0	15.0	0.71
<i>M. rebeli</i>	(Poland) 1	1	0	1	0	13.4	1.22
	? (Italy) 1	1	0	1	0	13.0	0.71
<i>M. arion arion</i>	(Poland) 0	01	0	1	0	9.8	1.10
	(Poland) 0	01	0	1	0	13.6	0.55
	(Slovakia) 0	1	0	0	0	11.2	0.84
	(Switzerland) 1	1	0	0	1	10.4	1.52
	(Italy) 1	1	0	0	0	11.0	1.22
<i>M. a. xiaheana</i>	0	01	01	0	0	11.4	0.55
	01	1	0	0	0	11.0	0.71
	1	1	0	0	0	10.8	0.84
	1	1	0	01	0	9.8	0.82
<i>M. a. ussuriensis</i>	1	1	0	0	0	11.8	1.48
	1	1	0	0	0	10.8	0.82
<i>M. arionides arionides</i>	01	01	0	1	0	12.4	0.89
	1	01	0	01	0	11.4	0.55
<i>M. a. takamukui</i>	1	1	0	01	0	13.0	1.00
<i>M. nausithous</i> (Poland)	1	0	0	0	0	11.2	0.84
<i>M. teleius teleius</i>	0	0	0	1	0	11.4	0.55
<i>M. t. euphemia</i>	0	01	0	1	0	(3) 17.3	4.62
	0	1	0	0	0	12.6	1.52
	0	0	01	0	0	14.8	0.84
<i>M. t. sinalcon</i>	1	1, 0	0	0	0	12.6	0.89
<i>M. t. kazamoto</i>	0	0	1	0	0	15.0	1.22
<i>M. t. ogumae</i>	0	1	0	0	0	15.4	0.89

*Index*

Length: 1=appreciably longer than broad.

0=short, almost as long as broad.

Tip rounded: 1=smoothly roundish.

0=straightly cut off or "truncate".

Tip angular: 1=centrally pointed.

0=not so.

Tip dilated: 1=broadened distad.

0=not so, lateral edges parallel.

Tip tapering: 1=narrowed distad.

0=not so.

"01" means 'somewhat tending to "1"'.  
\* This column indicates number of samples: uniformly 5, except for those cases where the figures are given in parenthesis.

may be outlined as below. As stated already in relation to androconia, this grouping largely agrees with the one deducible from androconial morphology (except *kurentzovi* in which androconia are missing).

a. The *alcon* group

Ring weakly protruded cephalad much above its middle in lateral aspect ; expansion of lateral process of tegumen weak ; tegumen moderately inclined caudad. Socius rather small, in ventral aspect (Fig. 32D) roundly protruded cephalad at the level of base of falx. Falx rather short, weakly curved at the middle, tapering on distal half, with its tip not approximating base of opposite one. Valva parallel-sided, its ventrocaudal corner not overlapping that of the opposite valva, with its mesal surface densely clothed with suberect hairs which cover even costa of valva ; distal hook of valva short, directing ventrodistally, shorter than half of distal margin of valva, bare or weakly serrate ; distal margin of valva oblique to its ventral margin, so that ventrodistal corner sharply pointed. Juxta with a longish stalk. Phallus slightly shorter than height of ring (length of phallus is measured excluding Chapman's process), very thick at the level of zone,  $0.23-0.25\times$  as thick as long ; suprazonal portion (from zone to tip of dorsal sclerite under condition of vesica everted) rather long,  $0.36-0.39\times$  length of subzonal portion ; Chapman's process long,  $0.6-1.1\times$  suprazonal portion,  $0.13-0.20\times$  full length of phallus ; vesica very stout, band-like lateral sclerite short,  $0.33-0.46\times$  length of dorsal sclerite of aedoeagus, evenly slender to tip ; dorsal group of cornuti consisting of large spines irregularly arranged in 3-4 rows ; ventral group of cornuti longer than the dorsal group, consisting of spines as large as dorsal ones, arranged irregularly in 3-5 rows.

b. The *arion* group

Ring weakly produced cephalad slightly above the middle in lateral aspect ; expansion of lateral process of tegumen moderately strong ; tegumen moderately inclined caudad. Socius moderately large, in lateral aspect angulately produced above the level of base of falx. Falx long, strongly curved at the middle, weakly tapering on distal half, with tip usually crossed the opposite one. Valva very much dilated distally, overlapping the opposite valva at ventrodistal corner, its mesal surface clothed with subdecumbent hairs which do not cover costa ; distal hook of valva directing ventrodistally, very long and cylindrical, longer than  $2/3$  of distal margin of valva, densely covered with denticles except on apical portion ; a weak projection at base of distal hook of valva ; distal margin of valva oblique to its ventral margin, so that ventrodistal corner of valva sharply pointed. Juxta with short broad stalk. Phallus as long as height of ring or slightly shorter, moderately slender, at the level of zone  $0.19-0.20\times$  as thick as long ; suprazonal portion moderately long,  $0.30-0.36\times$  as long as subzonal sheath ; Chapman's process moderately long,  $0.5-0.8\times$  as long as ventral sclerite of aedoeagus,  $0.09-0.12\times$  length of phallus ; vesica moderately thick, band-like lateral sclerite moderately long,  $0.6-0.87\times$  length of dorsal sclerite of aedoeagus, its distal portion dilated but without prominent spicules ; dorsal group of cornuti consisting of rather small spines, irregularly arranged in 3 rows ; ventral group of cornuti nearly  $3/4$  length of dorsal group, consisting of spines as large as those of dorsal spines, irregularly arranged in 3-4 rows.

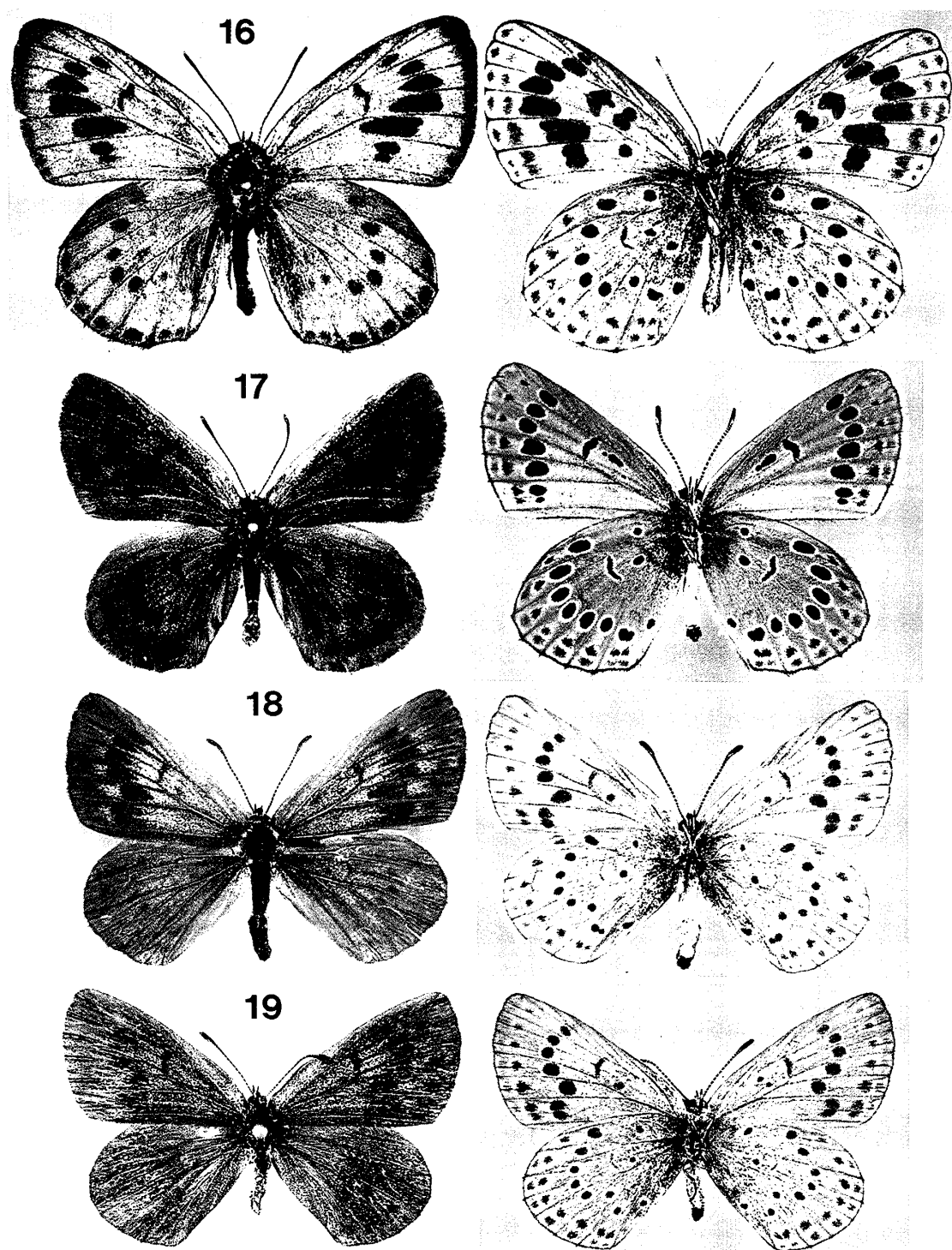
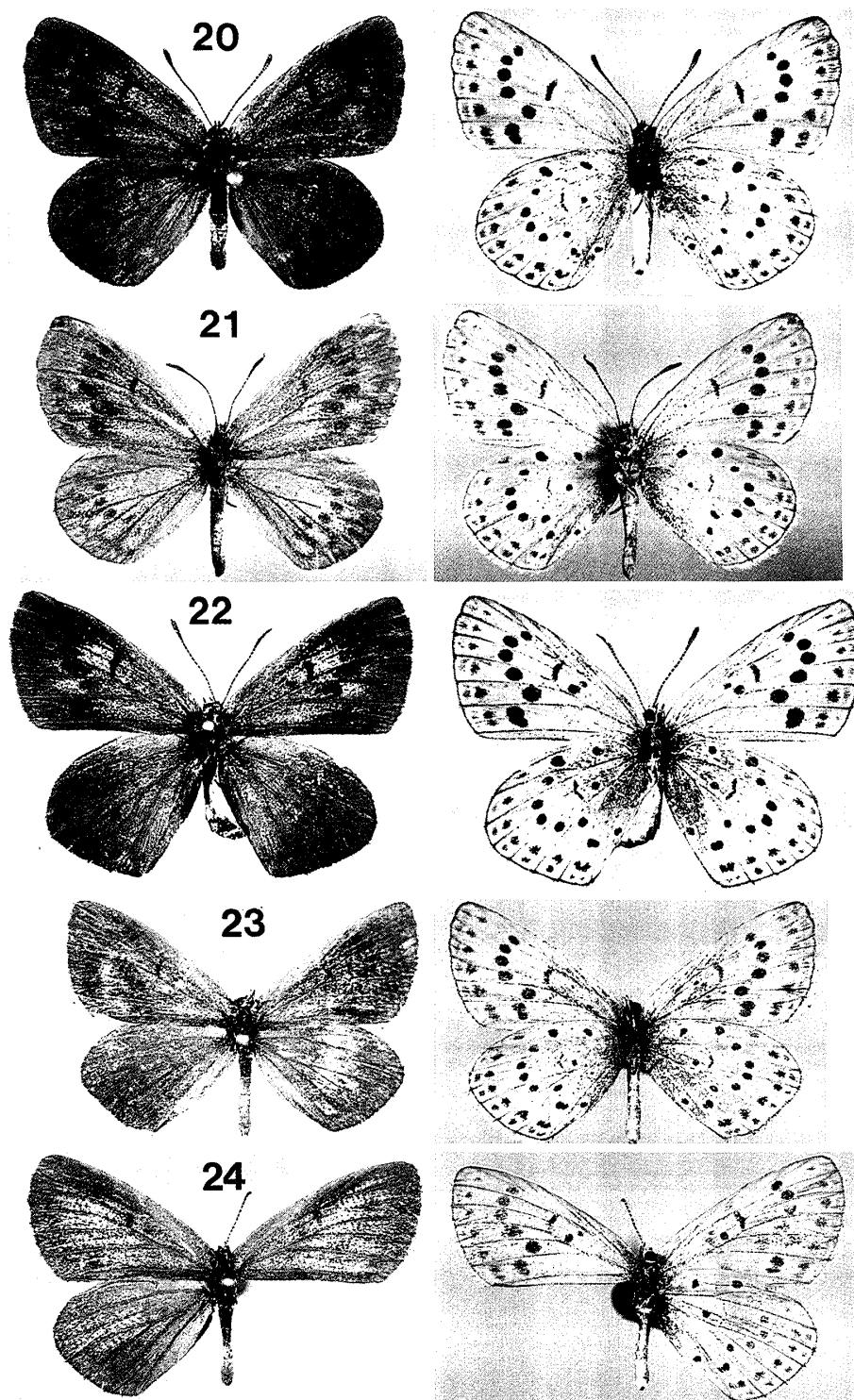


Fig. 16. *M. arionides arionides* (Staudinger, 1887), ♂, Puksibichan, SW Primor'e, Russia.  
 Fig. 17. *M. teleius euphemia* (Staudinger, 1887), ♀, Sinin Mountains, SE Primor'e, Russia ;  
 a specimen with strongly marked postmedian spots on ventral surface which  
 corresponds to pl. 14, fig. 24 of Kurentzov (1970) illustrated as *M. arion ussuriensis*  
 [misidentification], ♀.



Figs 18-24 (see also Figs 9-10). *M. kurentzovi* sp. nov. 18-19. ♀♀. 18: Ternei, Primor'e. 19: Haesan, Ryanggang-Do, N Korea. 20-24. ♂♂. 20: Haesan, and 21: Paegam, Ryanggang-Do, N Korea. 22: Puksibichan, SW Primor'e. 23: Chita, upper Amur River. 24: Lahasusu, at the merging point of Sungari and Amur/Heilong-jiang River.

c. The *teleius* group

Ring strongly produced cephalad at the middle in lateral aspect; lateral process of tegumen strongly expanded; tegumen strongly inclined caudad along body axis. Socius of moderate size to very large, in lateral aspect rather angulately produced caudad at the level of base of falx. Falx long, strongly curved at the middle, not tapering on distal half, its tip well approximating that of opposite one or crossed therewith. Valva much dilated distally, overlapping opposite one at ventrodistal corner, its inner surface clothed with subdecumbent hairs which do not cover costa of valva; distal hook of valva directed ventrodistad or ventrad, long,  $0.4-0.5 \times$  length of distal margin of valva or longer, cylindrical or more or less lamellate, with serration on its distal margin; distal margin of valva oblique or perpendicular to its ventral margin, so that ventrodistal corner of valva sharply pointed, right-angled or rounded. Juxta with short stalk or V-shaped. Phallus long,  $1.1-1.2 \times$  height of ring, slender, at the level of zone  $0.14-0.15 \times$  as thick as long; suprazonal portion short,  $0.15-0.25 \times$  as long as subzonal portion; Chapman's process very short,  $0.35-0.4 \times$  length of ventral sclerite of aedoeagus,  $0.04-0.07 \times$  length of phallus; vesica moderately slender; band-like lateral sclerite very long,  $1.1-2.4 \times$  as long as dorsal sclerite of aedoeagus, with its distal portion dilated and covered with minute spicules; dorsal group of cornuti consisting of small spines irregularly arranged in 2-6 rows; ventral group of cornuti well developed,  $1.1-1.3 \times$  as long as dorsal group, consisting of similarly small spines as in dorsal group which are irregularly arranged in 4-10 rows.

The *teleius* group may further be divided into the *teleius* and *nausithous* subgroups which may be distinguished from each other as follows.

c-1. The *teleius* subgroup. Socius larger; dorsum more strongly inclined caudally. Valva more strongly dilated distally, with its distal margin perpendicular to ventral margin, so that ventrodistal corner of valva right-angled or obtuse; distal hook of valva directed morphologically ventrad or ventroproximad hence actually mesad, lamellate except for apical cylindrical portion, and bearing a series of serrations along distal margin.

c-2. The *nausithous* subgroup. Socius smaller; dorsum less strongly slanted posteriad. Valva less strongly dilated distally, with its distal margin oblique to ventral margin, so that ventrodistal corner of valva acutely pointed; distal hook of valva directed ventrodistad, cylindrical, and bearing scattered denticles which are not arranged in a row on distal surface.

*Female genitalia.* The female genitalia of the genus *Maculinea* do not seem to have been described and illustrated in detail. Here we have not examined female genitalia of the related taxa, and simply give a general aspect of genitalia in this genus, without offering distinctive features as against related genus-group taxa such as the genus *Glaucopsyche*. Just as with male genitalia, the genus *Maculinea* may be divided into three groups on the basis of female genitalia. This grouping well tallies with that obtained with androconia and male genitalia.

General characters of the genus *Maculinea*: Ventral sclerite of 6th abdominal segment quadrate, rectangular or sometimes triangular. Lodix, ventral sclerite of 7th abdominal segment, well developed covering most part of 7th abdominal area. Apophysis anterioris short, less than  $1/8$  length of 8th tergum, or absent. Intersternal membrane between 7th and 8th abdominal venters usually invaginated to form intersternal pouch which is sclerot-

ized to some extent; its ventral wall with a pair of shallow cavities, probably acting as keyholes to be hooked by male falces. Genital plate present ventrad of ostium, variable in shape: tongue-shaped, triangular or semicircular; swelling or tubercles of various sizes present on its dorsal base. Bursa copulatrix relatively short,  $1.6-2.0\times$  as long as 8th tergum; corpus bursae ellipsoidal or guttiform; signum absent. Ductus bursae slender; caudal portion near ostium sometimes broadened. Ductus seminalis very slender in its entirety, attached to caudal portion of ductus bursae. Eighth abdominal venter moderately haired, sometimes furnished with long hairs. Papilla analis of moderate size, triangular in lateral view, with slender or thick apophysis posterioris at the middle of cephalic margin.

a. The *alcon* group

Ventral sclerite of 6th abdominal segment long-triangular,  $0.83\times$  length of lodix. Lodix rectangular. Apophysis anterioris short and acuminate,  $0.12\times$  as long as 8th tergum. Cavities of intersternal membrane shell-like, markedly closer than in most species of the other groups of this genus. Genital plate triangular, caudal margin rounded, with a ventral median keel which is dilated anteriorly. Ductus bursae not broadened at caudal portion. Eighth abdominal venter moderately hairy. Papilla analis of moderate size and weakly built,  $0.45\times$  as long as 8th tergum. Apophysis posterioris relatively short and slender.

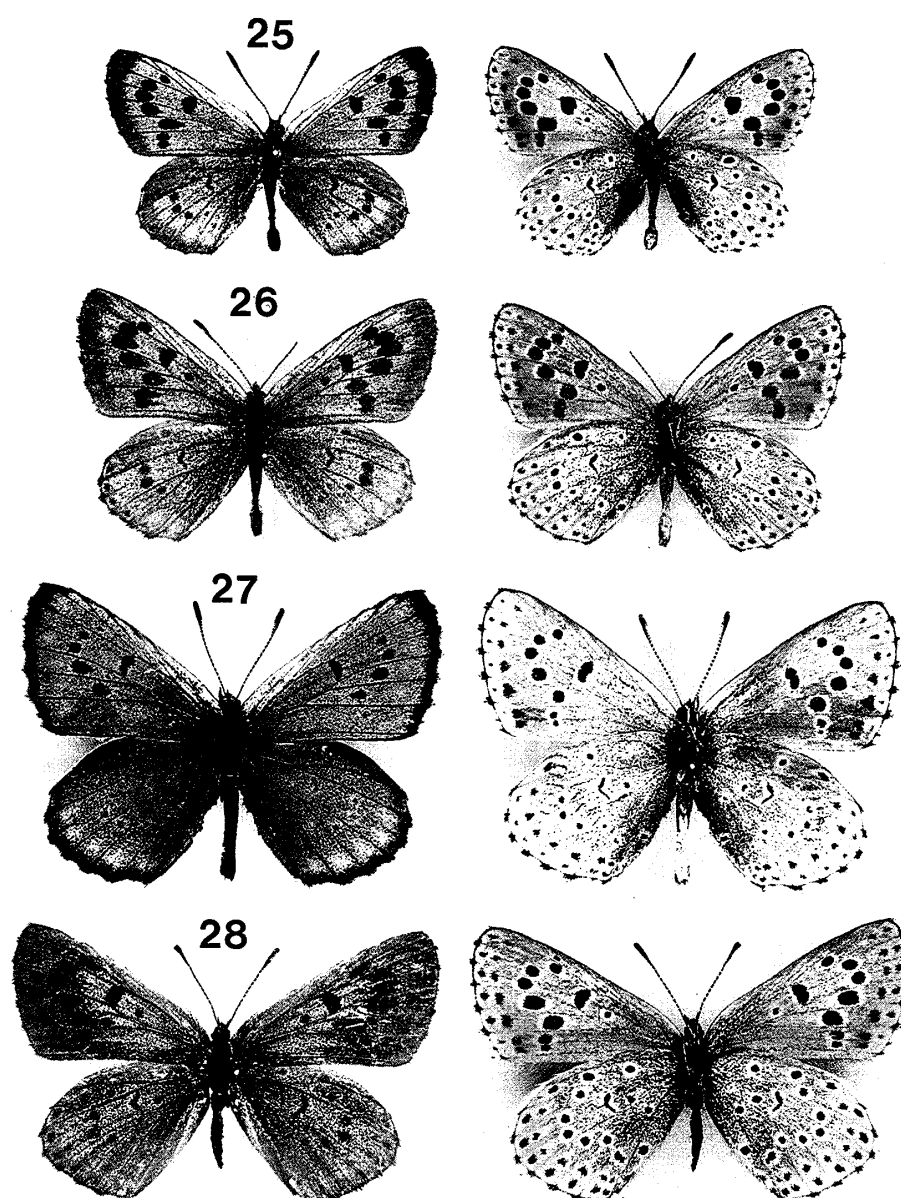
b. The *arion* group

Ventral sclerite of 6th abdominal segment moderately large, nearly quadrate, circular or ellipsoidal,  $0.81-0.92\times$  as long as lodix. Lodix quadrate, extremely large. Apophysis anterioris short and acuminate as in the *alcon* group. Cavities of intersternal membrane relatively shallow, posterior ridge distinct. Genital plate tongue-shaped, slightly bent dorsally, with weak median keel ventrally. Ductus bursae not broadened at caudal portion. Eighth abdominal venter haired as in the *alcon* group. Papilla analis, relatively small,  $0.34-0.39\times$  as long as 8th tergum. Apophysis posterioris long and slender.

c. The *teleius* group

Ventral sclerite of 6th abdominal segment apparently small and short, nearly quadrate or semicircular,  $0.57-0.61\times$  as long as lodix. Lodix quadrate, large. Apophysis anterioris indistinct or absent. Cavities of intersternal membrane weakly sclerotized, inner ridge usually distinct. Genital plate large, semicircular. Ductus bursae somewhat broadened at caudal portion near ostium. Eighth abdominal venter furnished with rows of relatively long hairs (but not in *teleius*) from subventral areas to caudal margin. Papilla analis large, strongly built,  $0.46-0.54\times$  as long as 8th tergum. Apophysis posterioris relatively wide and thick.

Although the structure is fairly simple and uniform, some features are usable for distinction of the intrageneric species group. The ventral sclerite of the 6th abdominal segment is triangular in the *alcon* group, nearly quadrate or rectangular in the others; it is apparently small in the *teleius* group. The apophysis anterioris is short and acuminate in the *alcon* and *arion* groups, but indistinct or absent in the *teleius* group. The genital plate exhibits certain distinct specific characters. The ductus bursae is uniformly slender, but in the *teleius* group it is broadened at caudal portion near the ostium. The papilla analis is small and weakly built in the *alcon* and *arion* groups but rather large and strongly built in the *teleius* group. The apophysis posterioris is slender and thin in the *alcon* and *arion*



Figs 25-28 *M. arion philidor* (Fruhstorfer, 1915) from the eastern end of the Qilian Range, Gansu, China. 25-27: ♂♂. 28: ♀.

groups, while it is rather wide and thick in the *teleius* group.

*Life history.* The peculiar life history of the five species of *Maculinea* occurring in Europe is now well documented, and in spite of the proposal made recently by Bálint (1989a) to treat *Maculinea* as a subgenus of *Glaucopsyche* on the basis of external morphology of the adult, the rather uniform association of *Maculinea* larvae with specific ants after the third instar seems to be a good reason to retain the generic status of *Maculinea*. As far as is known of the *Maculinea* species from the East Palaearctic Region, there is no exception with this rule, although the majority of the Asian taxa of *Maculinea* still awaits discovery and exploration of their life history.



1. *Maculineaalcon* ([Denis & Schiffermüller], 1775)

(Figs 1-4 adults ; 30A map ; 31A, B androconia ; 32, 33 male genitalia ; 45 female genitalia)

*Papilioalcon* [Denis & Schiffermüller], 1775 : 182.*Maculineaalconalcon* : D'Abbrera, 1993 : 484-485, figs (♂♂ ♀).

The species has so far been generally known from Europe to Asia, but only a very few specimens have been known from East Asia. This notion is now partially revised in this paper.

According to Thomas & Elmes (1989), two sibling species, differing in their specific association with ants during the late larval stages, are recognized in Europe: *M.alcon* ([Denis & Schiffermüller], 1775) and *M.rebeli* (Hirschke, 1904), which apparently cannot be distinguished with certainty in adults. Therefore, the records and distribution in Asia must be interpreted with reservation.

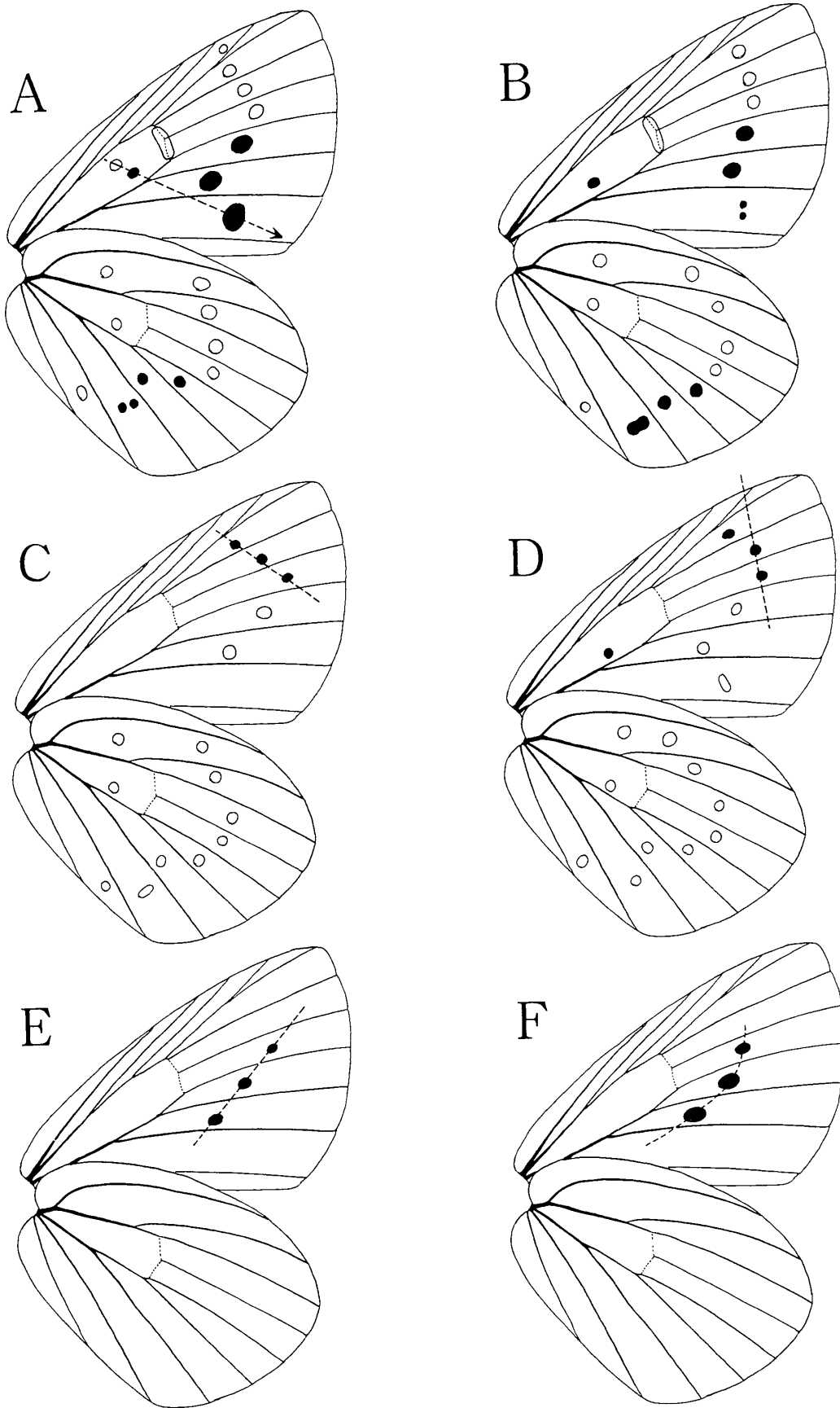
A. *Maculineaalconkondakovi* (Kurentzov, 1970), **comb. nov.**

(Figs 1 ♂, 2 ♀ ; 31B androconium)

*Lycaena kondakovi* Kurentzov, 1970 : 142, partim (♂, lectotype here designated) (Primor'e).*Glaucopsyche (Maculinea)alcon* : Sibatani, 1940 : 33, figs 7, 8 (♂) (NE China : Aihun), nec [Denis & Schiffermüller], 1775.*Maculineaalcon* : Seok, 1973 : 300-301 (southern China NE : records unconfirmed), partim ? nec [Denis & Schiffermüller], 1775.

Kurentzov (1970) noted records of *alcon* from Mongolia (Kentei Mountains) and E of Baikal (Yablonoj Range) by Staudinger (1892, 1897), but he himself apparently did not recognize the species and regarded 1 ♂ probably collected by himself in Primor'e as a new species: *Lycaena kondakovi* Kurentzov, 1970. Syntypes of *kondakovi* include another specimen, a ♀, which belongs to a genuine new species. Here we revise the nomenclature by designating the ♂ as lectotype of *kondakovi* (Kurentzov, 1970) (Fig. 1) and renaming the new species represented by the ♀ paralectotype of *Lycaena kondakovi* (= *M.kurentzovi* sp. nov.) (Fig. 10) with a separate ♂ specimen from northern Korea selected as holotype (see below). Moreover, there are a few other records of *alcon* species from East Asia. The records from China NE and northern Korea by Seok (1973) are uncertain as to their subspecific identity, because of the possible involvement of *arivang*, subsp. nov. (Fig. 9, see below). The only known ♀ specimen of *alcon* from E Asia (Fig. 2) was located in the collection of Höne housed at MAK. Because of the paler ventral surface ground colour of both wings in both sexes than that of European specimens of *alcon*, we here retain *kondakovi* as the subspecific name of *alcon* from east Asia. Subspecific identity of populations occurring in Mongolia and the Yablonoj Range remains unknown to us.

Type. *Lycaena kondakovi* Kurentzov, lectotype ♂, here designated. RUSSIA, with label data "12. viii. 43 ♂ upper part Suputinka River, wavy stream wet meadow" (translated from Russian original label by Yu. A. Tshistjakov), which is identical with those found in the original description. The lectotype now bears the following additional labels "Syntypus *Lycaena kondakovi* Kurentz./1970/Kurentzov, 1970 : 142/(ovoen.) N. Ya Azarova, 1985 (54)" (transliterated from Kirillic) "[LECTOTYPE] /*Lycaena kondakovi*/Kurentzov, 1970/designated by Sibatani,/Saigusa et Hirowatari,/1994", in IBP (examined).



Other material examined. CHINA NE—1 ♂, Aihun 瑷珲, opposite to Blagoveshchensk across the Amur/Heilong-jiang 黑龍江, vii.-viii. 1939 (O. Suzuka), SM; RUSSIA—1 ♀, Upper Amur Region, Chita (Höne), MAK.

FL. ♂♂ 20.0 mm (*kondakovi* lectotype) and 19.0 mm; ♀ 17.6 mm. (cf. *alcon alcon* from Europe: ♂♂ 17.0–19.0 mm, ♀♀ 17.0–19.3 mm; *M. rebeli* from Poland and possible specimens from Italy: ♂♂ 15.0–18.5 mm, ♀♀ 18.0–18.3 mm.)

This subspecies may be distinguished from *alcon* (s.str.) by paler brown ground colour of the ventral surface in both sexes. The presence of dark crescent at the cell end of the ♂ dorsal FW as seen in lectotype (Fig. 1) may not be a reliable characteristic.

Androconia. With both *kondakovi* (Kurentzov) lectotype (Fig. 31B) and the nominotypical *alcon* (Fig. 31A) as well as *M. rebeli* (Fig. 31C) from Europe, androconia are abundant, look clear, ellipsoidal, with moderate number of ribs (Tables 1 and 2).

Genitalia. Male and female: The species characteristics agree with those of the *alcon* group as a whole. It is difficult to establish differences among various taxa of the group: *M. alcon alcon* (Fig. 32), *M. alcon kondakovi* (not figured) as well as *M. rebeli* (Fig. 34) from Europe.

Early stages. Completely unknown.

Distribution. East Asia including Upper Amur River, Primor'e and China NE.

The label data of *kondakovi* lectotype indicate that Kurentzov collected it near Gornotay-ozhnaya Montane Forest Station (20 km SE of Ussurisk) where he used work during the early days of his career (Tshistjakov, in litt.). Despite the search which he and others must have made since its discovery, not a second specimen of *alcon* has apparently been obtained from Primor'e. The question arises why the species has been collected so seldom in this part of the Palaearctic Region. Only through exploration of its status could its specific identity be analysed in relation to the European *alcon* and *rebeli*.

## B. *Maculinea alcon arirang* subsp. nov.

(Figs 3, 4 ♂♂; 31D–F androconia; 33 male genitalia)

*Maculinea alcon*: Seok, 1973: 300–301 (N Korea: records unconfirmed), partim?; Lee, 1982: 39.

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Fig. 29. Diagrams of patterning of some *Maculinea* taxa for identification of various species or subspecies. Spots on the ventral surface are shown. Solid markings are the crucial ones for contradistinction of similar taxa. Veneations in different diagrams simply represent a "prototype", without implying differences between representative taxa. A: *M. kurentzovi* sp. nov.; the line connecting the two spots in the cell of the FW points to the tornus. B: *M. teleius* (Bergsträsser, [1779] 1778–1780). C: *M. alcon arirang* subsp. nov.; note the quasi-linear arrangements of the three postmedian spots in  $R_5-M_3$  on the FW. D: *M. alcon alcon* ([Denis & Schiffermüller], 1775) and *M. alcon kondakovi* (Kurentzov, 1970); note the position of the spot in  $M_2-M_3$  of the FW, which also applies to *M. nausithous* (Bergsträsser, [1779] 1778–1780). E: *M. alcon arirang* subsp. nov.; note the linear arrangement of the three spots in  $M_2-CuA_2$ . F: *M. kurentzovi* sp. nov.; the three spots are in a curved arrangement.

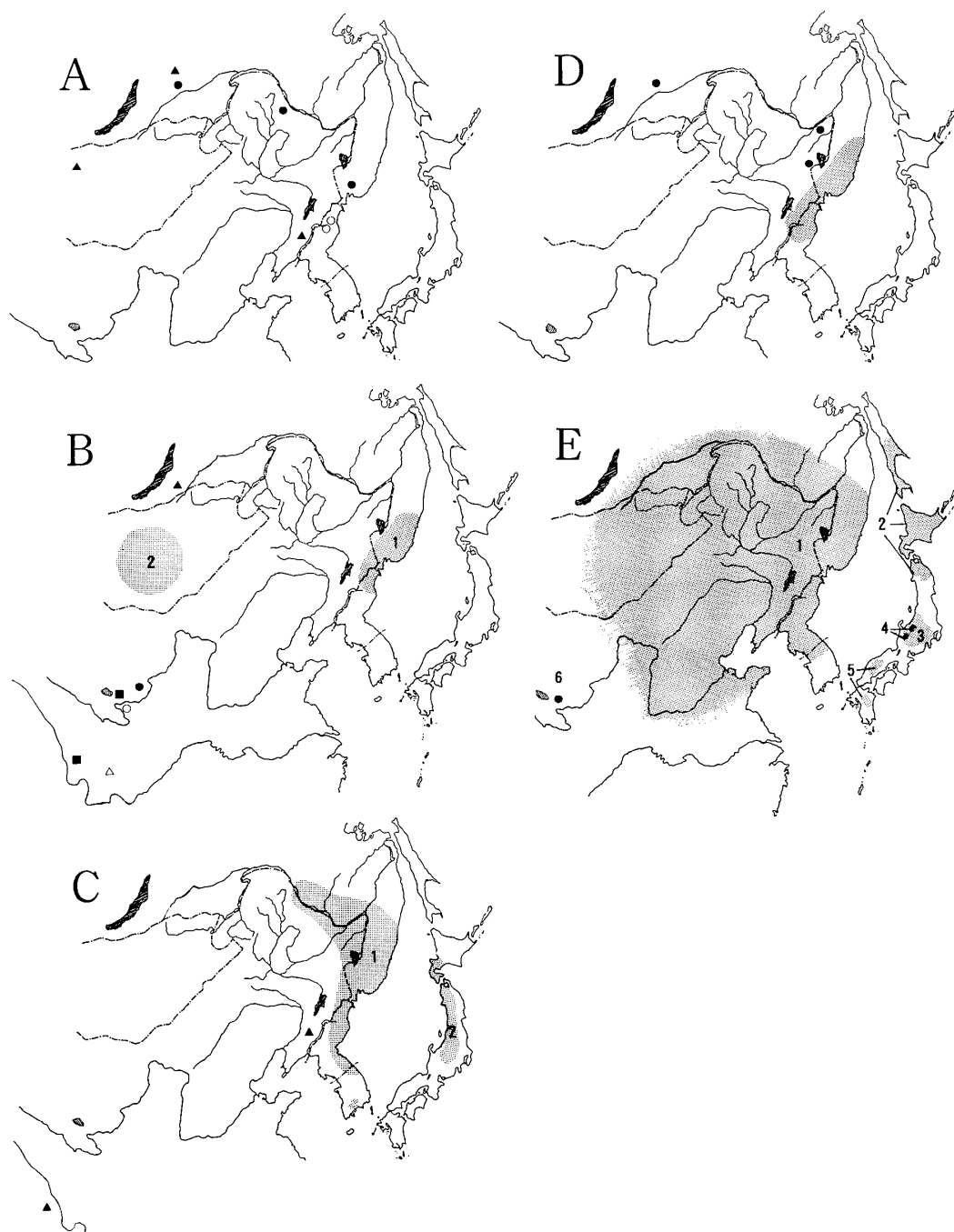


Fig. 30. Distribution maps of *Maculinea* taxa in the East Palearctic Region. A. *M. alcon* ([Denis & Schiffermüller], 1775). Solid circle (●): *M. alcon kondakovi* (Kurentzov), empty circle (○): *M. alcon arirang* subsp. nov., solid triangle (▲): exact locality and subspecific identification unconfirmed. B. *M. arion* (Linnaeus, 1758). 1: Subsp. *ussuriensis* (Sheljuzhko, 1928), 2 and tentative solid circle (●): subsp. *philidor* (Fruhstorfer, 1915), empty circle (○): subsp. *xiaheana* (Murayama, 1991), solid square (■): subsp. *inferna* nom. nov., empty triangle (△): uncertain type locality in the former Tibet (now probably in Sichuan) of *tatsienluica* (Oberthür, 1910) = *inferna* nom. nov. C. *M. arionides* (Staudinger, 1887). 1: Subsp. *arionides* (Staudinger), 2: subsp. *takamukui* (Matsumura, 1919). D. *M. kurentzovi* sp. nov. The circumscribed area with many data as well as individual isolated data are indicated with solid circle (●). E. *M. teleius* (Bergsträsser, [1779] 1778-1780).

Types. Holotype, ♂. DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA—Ryanggang-Do [两江道], labelled “Taihyoo-Taitinpyoo (Kan-nan [=Ham-nam 咸南]) [=Taep'yong-Gu 大坪区-Taejinpyong 大鎮坪, NE of Poch'onbo 普天堡 now in Ryanggang-Do], Corea 8. viii. 1934” [S. Asahina], KUB. Paratypes 5 ♂ : 1 ♂, labelled as holotype. 4 ♂, Ryang-gang-Do near Samjiyon [Santiën 三池淵], Taechongdan, 8. viii. 1989. 2 ♂ (E. Palik), ISEZ, 2 ♂ (J. Kozlielec), WE.

Holotype. ♂, FL 16.0 mm. Different from *alcon* (s. str.) and *kondakovi* in the following points: smaller, on both wings dorsal surface ground colour less shiny purplish blue, intervenous spaces suffused with white scales towards termen with suggestions of black marginal spots in spaces Rs-M<sub>3</sub> on HW; on ventral surface spots as in *alcon* (s. str.) and *kondakovi*, but ground colour even lighter than the latter, slightly brownish light grey, rather than brownish as in *alcon* (s. str.) or light brown in *kondakovi*, with postmedian series of spots strongly marked and shifted distad on both wings, especially the one in M<sub>2</sub>-M<sub>3</sub> on FW, situated close to submarginal spot, lying more distad than spot in M<sub>1</sub>-M<sub>2</sub>, so that 3 postmedian spots in R<sub>5</sub>-M<sub>3</sub> almost in line, whereas in other subspecies it is convex caudad (Fig. 29C). Fringes pure white.

Paratypes. FL 12.6-16.0 mm. One from the type locality very similar to the holotype but with others from Samjiyon dorsal ground colour darkish non-metallic blue with veins dark brown near termen and cephalic half of both wings; size of postmedian spots on ventral surface variable.

Female. Unknown.

Androconia. Abundant as in *kondakovi* lectotype, but not so much as a specimen of *alcon* (s. str.) (Table 1); they look less clear than ones of these two specimens, the shape quite variable, either ellipsoidal and similar to that of *alcon* (s. str.), more roundish or else large and slightly elongated, but generally the ribs tend to be more numerous (Table 2) than in specimens examined of the two other subspecies and *rebeli*.

Genitalia. Male (Fig. 33): Similar to those of *alcon* (s. str.) and *kondakovi*.

Early stages. Completely unknown.

Distribution. So far known only from two highland localities SE aspect of Paegdusan 白頭山 of N Korea, one of them (Taechongdan: exact locality and Chinese characters unclear) at the altitude of 1,600 m.

The four paratype specimens were collected on one of the Polish Academy of Sciences expeditions to N Korea (See Razowski, 1989), at only one locality, Taechongdan. According to E. Palik who collected two specimens, this place is ca. 1,600 m, situated about 40 km east of the town Samjiyon (=Santiën 三池淵); the biotope is a very flat moorland (ca. 1 km<sup>2</sup>), covered densely by bushes with *Vaccinium uliginosum*, the area being surrounded by dense pine forests; the butterflies flew singly and about a third of all the sighted specimens were collected during two hours in the sun; on the wing in the same biotope were *Colias palaeno* (Linnaeus), *Vacciniina optilete* (Knoch) and *Coenonympha hero* (Lin-

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1: Subsp. *euphemia* (Staudinger, 1887), its north-western and southern limits extremely uncertain, 2: subsp. *ogumae* (Matsumura, 1910), 3: subsp. *kazamoto* (Druce, 1875), 4: subsp. *hosonoi* Takahashi, 1973, 5: subsp. *daisensis* (Matsumura, 1926), 6 (●): subsp. *sinalcon* Murayama, 1992.

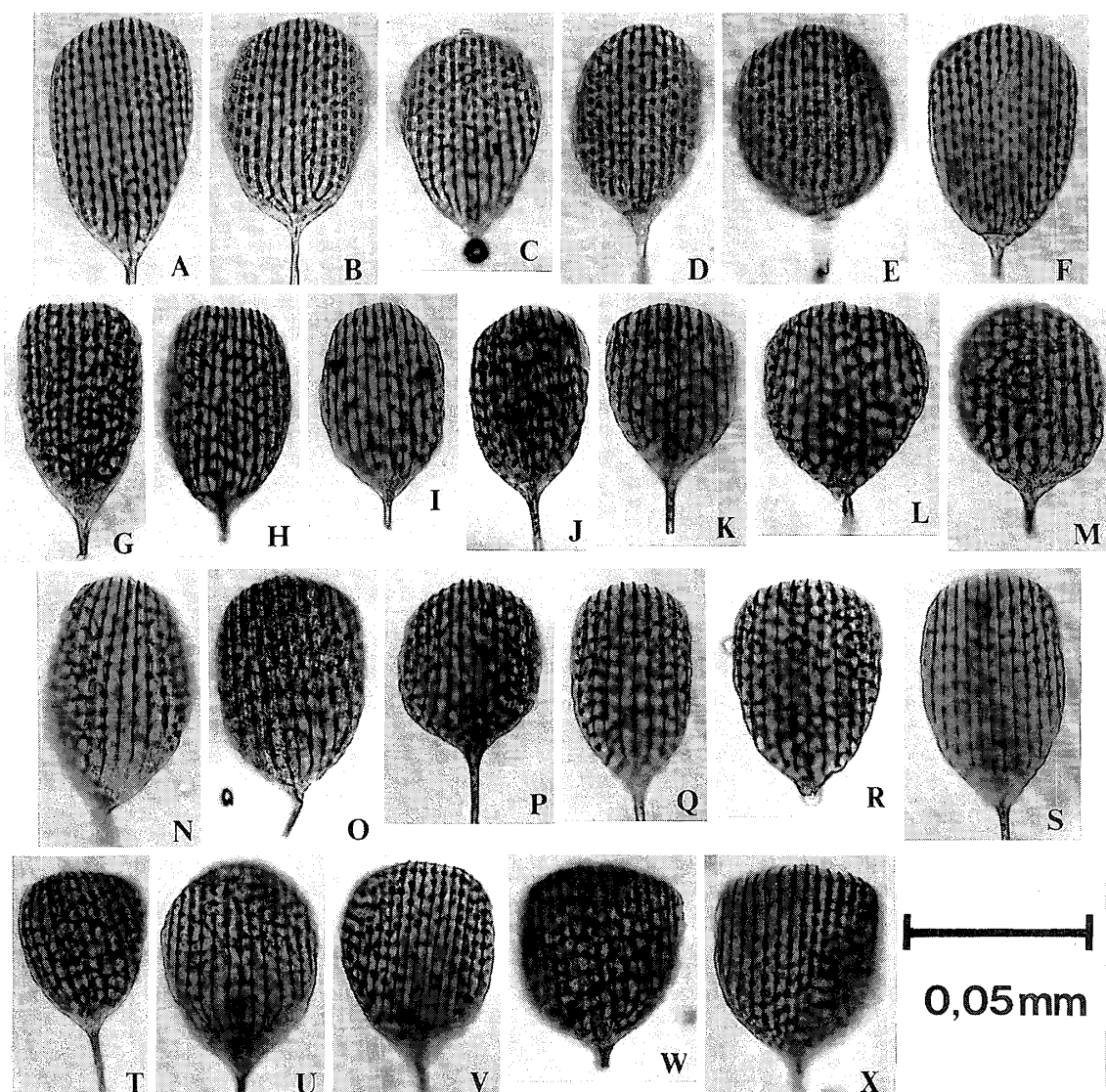


Fig. 31. Androconia of the genus *Maculinea*. Numbers are those attached to the specimens for reference of the mounted scale preparations. A. *M.alconalcon* ([Denis & Schiffermüller], 1775), Poland, No. 901. B: *M.alconkondakovi* (Kurentzov, 1970), Primor'e, lectotype of *Lycaena kondakovi* Kurentzov, 1970, No. 928. C. *M.rebeli* (Hirschke, 1904), Poland, No. 905. D-F. *M.alconarirang* subsp. nov., paratypes, Korea. D: No. 906, E: No. 939, F: No. 940. G. *M.nausithous* (Bergsträsser, [1779] 1778-1780), Poland, No. 909. H-I. *M.teleius sinalcon* Murayama, 1992, holotype, Qinghai, No. 913. J-K. *M.arionxiaheana* (Murayama, 1991), Gansu. J: No. 911, K: No. 938 (see also P). L-O. *M.arionarion* (Linnaeus, 1758). L: Poland, No. 918, M: Slovakia, No. 904, N: Switzerland, No. 931, O: Italy, No. 932. P. *M.arionxiaheana* (Murayama, 1991), Gansu, No. 914 (see also J, K). Q. *M.arionussuriensis* (Sheljuzhko, 1928), Korea, No. 916. R. *M.arionides arionides* (Staudinger, 1887), Primor'e, No. 935. S. *M.arionides takamukui* (Matsumura, 1919), Honsyû, No. 920. T-U. *M.teleiusteleius* (Bergsträsser, [1779] 1778-1780), Poland. T: No. 934, U: No. 919. V. *M.teleius ogumae* (Matsumura, 1910), Hokkaido, No. 907. W. *M.teleiuseuphemia* (Staudinger, 1887), Primor'e, No. 936. X. *M.teleius kazamoto* (Druce, 1875), Honsyû, No. 937.

naeus). The record from N Korea by Seok (1973) can not now be confirmed because Seok has never published the data (see Lee, 1982), and the original material must have been lost during the Korean War in 1950 (see Sibatani, 1987).

## 2. *Maculinea arion* (Linnaeus, 1758)

(Figs 6-8, 11-14, 25-28 adults; 30B map; 31J-Q androconia; 35, 36 male genitalia; 46 female genitalia)

*Papilio arion* Linnaeus, 1758: 483.

*Maculinea arion*: D'Abrera, 1993: 484-485, figs (♂♂ ♀).

We have a single subspecies along the Pacific coast of the Asian Continent. To the west and southwest a number of subspecies have been named: *cyanecula* (Eversmann, 1848) from "Caucasus to Mongolia", *philidor* (Fruhstorfer, 1915) from Mongolia, *nepete* (Fruhstorfer, 1915) from Gansu, Central China, *sosinismus* (Fruhstorfer, 1915) from Tianshan, *tatsienluica* (Oberthür, 1910) (preoccupied) from "Tibet" (see below), and *naruenta* (Courvoisier, 1910) from Turkestan, among others. Only occasional materials from recent captures in the "forbidden areas" of China (see Sibatani, 1991) have been brought before us, and we will only mention them in a non-systematic way without trying to be precise and exhaustive in our revision of the taxa from China and north (but not west) to it of the Asian Continent.

### A. *Maculinea arion ussuriensis* (Sheljuzhko, 1928)

(Figs 11 ♂; 12 ♀; 31Q androconia; 46 female genitalia)

*Lycaene arion ussuriensis* Sheljuzhko, 1928: 62, figs 8, 9 (♂) (S Ussuri and China NE: Pograditsinaya [= Suifenhe 綏芬河]); Sugitani, 1934: 164-168, pl. 14, fig. 1 (♂), 2 (♀), textfig. 1 (♂) (N Korea); Mori, Doi & Cho, 1934: 51, pl. 26, fig. 3 (♂) (N Korea); Kurentzov, 1970: 142 (Primor'e) (illustrated specimen on pl. 14, figs 23, 24 is *Maculinea teleius euphemia* (Staudinger); see p. 202).

*Maculinea arion ussuriensis*: Inomata, 1982: ix (Korea).

*Maculinea arion*: Seok, 1973: 302-303 (China NE, Japan!).

*Maculinea arionides*: Nire, 1919: 374, pl. 4, fig. 13 (♂) (N Korea: "Seisin" [= Chongjin 清津] and "Kwainei" [= Hoeryong 会寧], nec Staudinger, 1887.

Material examined. KOREA—Hamgyongbuk-Do 咸鏡北道, "Kwainei" [= Hoeryong 会寧] 4 ♂, 21-22. vii. 1930, 22. vii. 1931, 19. vii. 1934 (I. Sugitani), IS; 3 ♀, vii. 1931, 3. vii. 1933 (I. Sugitani), 1. viii. 1935 (K. Takeuchi), "Moanrei" [= Musanryong 茂山嶺]; 1 ♀, 27. vii./"Gokokujō" [= Hokuksong 護国城]; 1 ♀, 30. vii. 1935 (K. Takeuchi), UOP.

FL. ♂♂ 19.8-22.5 mm, ♀♀ 19.0-24.0 mm (all from Korea).

Butterflies are larger than *arion* (s. str.) (FL: ♂♂ 17.0-19.0 mm and ♀♀ 19.0-20.5 mm, the blue colour of ♂ dorsal surface less shiny and more purplish than that of *arion* (s. str.); ♀, unlike *arion* (s. str.), almost completely devoid of blue scales on dorsal surface.

Androconia. Comparison between European specimens (*M. arion arion*) (Figs. 31L-O) and *M. a. ussuriensis* (Fig. 31Q) has revealed the following. Moderately numerous (Table 1) in both subspecies and look darker than *alcon*. Shape of the scale and the number of ribs are quite variable among different populations and intrapopulation individuals in Europe; two specimens of *ussuriensis* had oblong shape and lesser numbers of ribs as in some other subspecies examined (Table 2).

Genitalia. Male: There is no definite specific difference between *M. arion* and *M. arionides* as well as among various subspecies thereof. They all well represent the characteristics of the *arion* group. Female: Ventral sclerite of 6th abdominal segment nearly quadrate, anterior corners rounded,  $0.81-0.86\times$  as long as lodix. Lodix very large, quadrate. Apophysis anterioris short and acuminate,  $0.11\times$  as long as 8th tergum. Cavities of intersternal membrane shallow, well separate from each other, caudal ridges nearly straight and distinct. Genital plate tongue-shaped, weakly bent dorsally, with 3 weak swellings at dorsal base just behind ostium; ventral surface with a weak median keel. Ductus bursae not broadened at caudal portion. Eighth abdominal venter moderately haired. Papilla analis relatively small and weakly built,  $0.34-0.38\times$  as long as 8th tergum. Apophysis posterioris long and slender. As to the species differences between *arion* and *arionides* see *M. arionides takamukui*.

Life history. This still remains unknown (*cf.* Park, 1987).

Distribution. Primor'e, Amur River, China NE, N Korea.

Kurentzov's key and description of *arion* are quite correct, but his figures of ♂ and ♀ do not conform to them. These figures must represent *M. teleius euphemia* (Staudinger); see below.

#### B. *Maculinea arion philidor* (Fruhstorfer, 1915)

(Figs 25-27 ♂♂; 28 ♀)

*Lycaena arion philidor* Fruhstorfer, 1915: 68 (Mongolia); Bollow, 1931: 295 (Mongolia).

*Glaucopsyche (Maculinea) cyanecula philidor*: Bálint, 1990: 6-7 (Mongolia).

*Maculinea arion*: Lee, 1993: 23 (Manchuria).

*Lycaena cyanecula* Eversmann, 1848: 207, partim.

*Lycaena arion cyanecula* Staudinger!: Seitz, 1911: 321 (Asia: from Caucasus to Mongolia), partim nec Eversmann, 1848.

*Maculinea arion cyanecula*: Bálint, 1987: 12 (Mongolia), nec Eversmann, 1848.

*Glaucopsyche (Maculinea) arion cyanecula*: Bálint, 1988: 96 (Mongolia); Bálint, 1989a: 91 (Mongolia); Bálint, 1989b: 105 (Mongolia). Nec Eversmann, 1848.

Bálint (1990) proposed to regard *Lycaena cyanecula* Eversmann, 1848 from Asia, so far regarded as an Asian subspecies of *M. arion* (Linnaeus, 1758) from Europe, as an independent (perhaps vicariant) species. According to Bollow (1931), the main feature of *cyanecula* is the extended blue-green suffusion to the wing border on the ventral HW. In addition, Bálint (1990) mentioned the more expanded FW, darker dorsal surface of ♀ wings and adaptation to dry habitat as characteristics of *M. cyanecula*. D'Abrera (1993: 484-485) illustrated specimens from East Turkestan as *M. cyanecula*, which he regards as a highly likely race of *arion*; these specimens have the dorsal blue colour of both sexes paler than European *arion*, narrower wings, and the extended blue-green suffusion on the ventral HW uniform in expanse and intense in coloration. According to Bálint (1990), Korshunov

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Figs 32-41. Male genitalia of the genus *Maculinea*. Unless otherwise noted, parts are designated thus: A. Whole genitalia, lateral aspect. B. Left valva, ventral aspect. C. Juxta, caudal aspect. D. Left socius and falx, ventral aspect. E. Phallus, lateral aspect. F. *Ditto* (distal portion), ventral aspect. G. *Ditto*, dorsal aspect. H. Apical portion of left valva, caudoventral aspect. I. Left valva, lateral aspect.



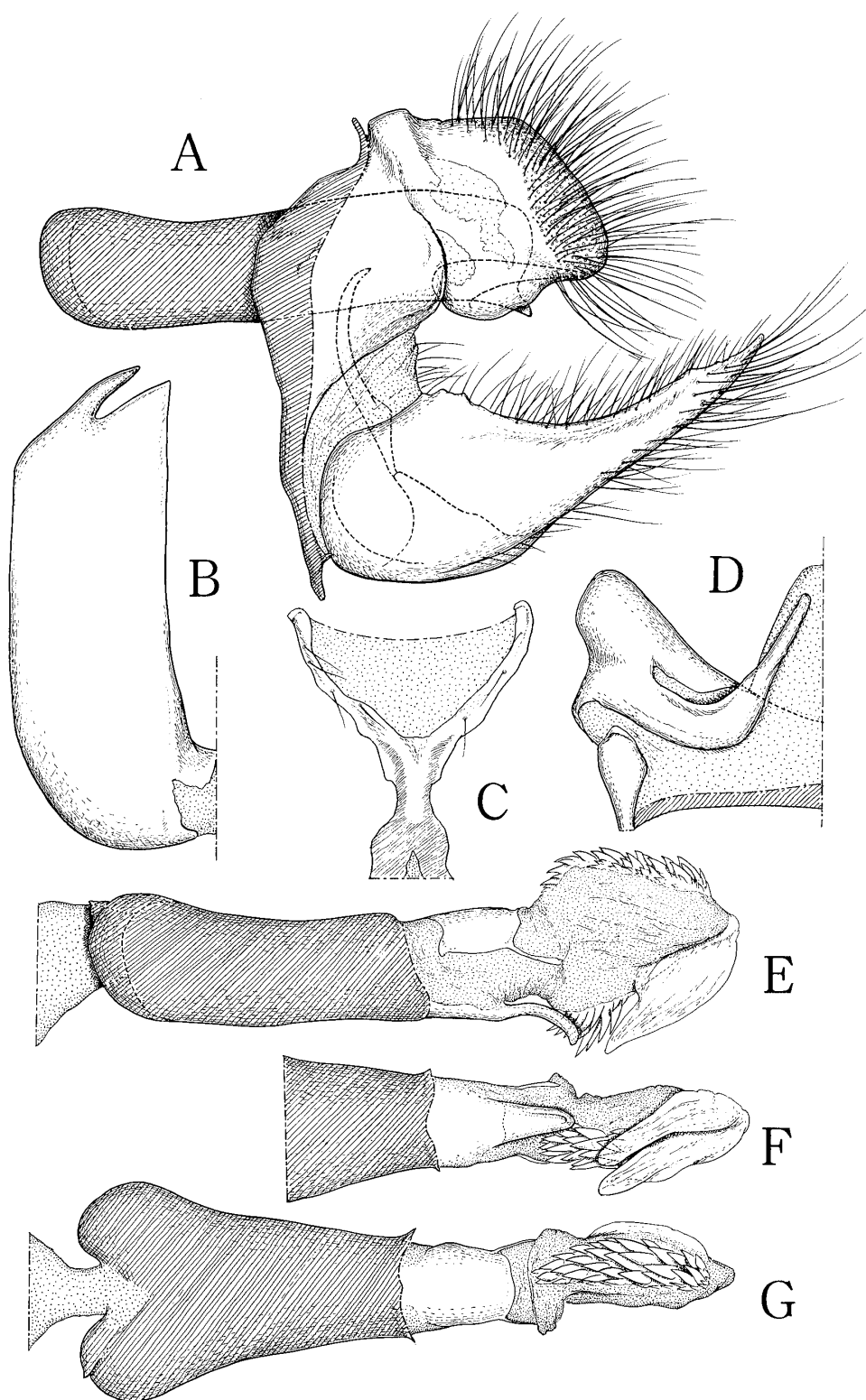


Fig. 32. *M. alcon alcon* ([Denis & Schiffermüller], 1775), Europe.

(1978) synonymized *philidor* with *cyaneacula*. Bálint (1987, 1988, 1989*a*, *b*) employed the subspecific name *cyaneacula* for Mongolian population, but later (Bálint, 1990) applied the subspecific name *philidor* (Fruhstorfer, 1915) to it in a new combination with his species *cyaneacula*, without clarifying the status of the types of these taxa as well as the difference between them. He illustrated in colour several adults of *philidor* from central Mongolia, of which 1 ♀ has a rather limited greenish-blue suffusion on the ventral HW and another ♀ has an almost totally dark dorsal wings, both being features of *ussuriensis* (Sheljuzhko, 1928). Certainly the colour of the dorsal surface in ♀ of his Mongolian specimens is variable, ranging from blue dominating to almost totally brown. Also, it is clear that on the average *philidor* has the metallic blue-green suffusion of the ventral HW less intensive than *xiaheana* from Gansu highlands to be mentioned below. The wings of *philidor* are not so conspicuously narrow as those of *cyaneacula* from Turkestan.

Just before completion of this work we have obtained a few specimens from the Qilian Range, situated at the northern border of Qinghai highlands, China (Figs. 25-28). These specimens are also variable in the wing markings. We wish to tentatively place them to *philidor*, without going into the detail of their morphological examination, whilst maintaining its specific identity as *arion*.

Material examined. CHINA—3 ♂ 3 ♀, Tianzhu County 天祝県 at the eastern end of the Qilian Range 祁連山脈 vi.-vii. 1982 (collectors unknown), AS.

FL. ♂♂ 14.3-18.0 mm, ♀♀ 16.5-19.0 mm.

Smaller than *arion* (s. str.). Both sexes are variable in size but generally resemble those of *philidor* illustrated by Bálint (1990); dark margins of dorsal wings in ♂ vary in width. One large ♂ (somewhat similar to Fig. 7—*xiaheana*) having narrow border and reduced postmedian spots like in *xiaheana* or *inferna* nom. nov. (see below); dull blue-green suffusion of ventral HW often limited to the wing base but sometimes extends beyond postmedian line but never reaching the wing border. Dorsal surfaces of wings in ♀ are not completely dark but with a limited blue areas on both wings. Wings are not particularly narrow.

Thus it seems that *philidor* represents an intermediate between *ussuriensis* and a typical *cyaneacula*. The action taken by Bálint (1990) leaves the position of *ussuriensis* (Sheljuzhko) in relation to *arion* (s. str.) somewhat ambiguous, so that we retain the conventional status of *cyaneacula* in this paper, and only follow Bálint (1990) for his recognition of *philidor* (Fruhstorfer, 1915) as a good subspecies. However, taxonomic revision of these butterflies will be accomplished only upon elucidation of their early stages in these remote, partially “prohibited” areas.

Early stages. Completely unknown.

Distribution. Central Mongolia and central China, northern Gansu Province; also possibly from SW end of China NE (Manchuria), near the border of Hebei Province.

We are not in a position to judge whether or not *Maculinea arion nepete* (Fruhstorfer, 1915: 67; Bullock, 1931: 294.) described from Gansu is synonymous with some other subspecies.

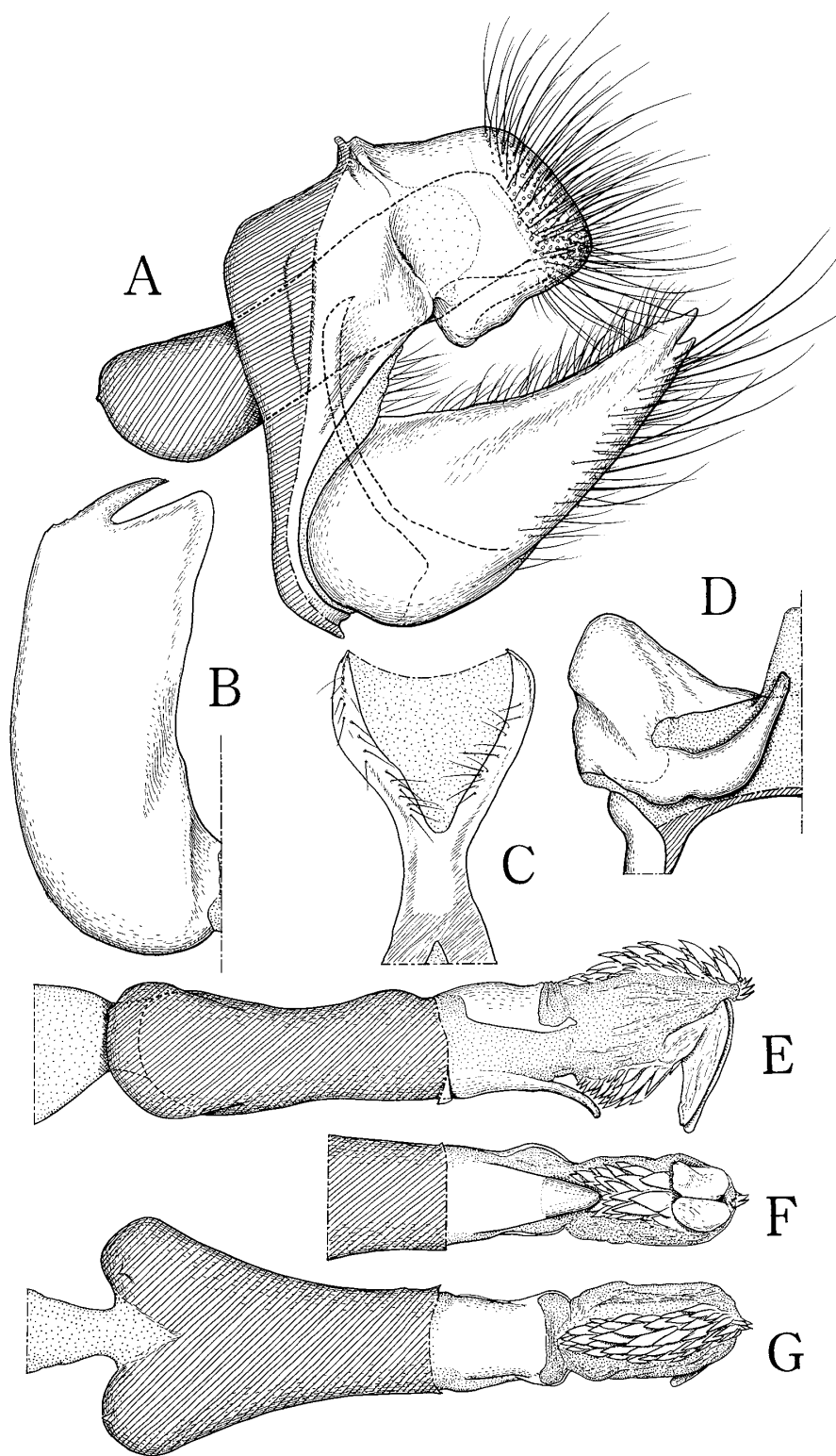


Fig. 33. *M. alcon arirang* subsp. nov., N Korea, Taechongdan, 8. viii. 1989, WE.

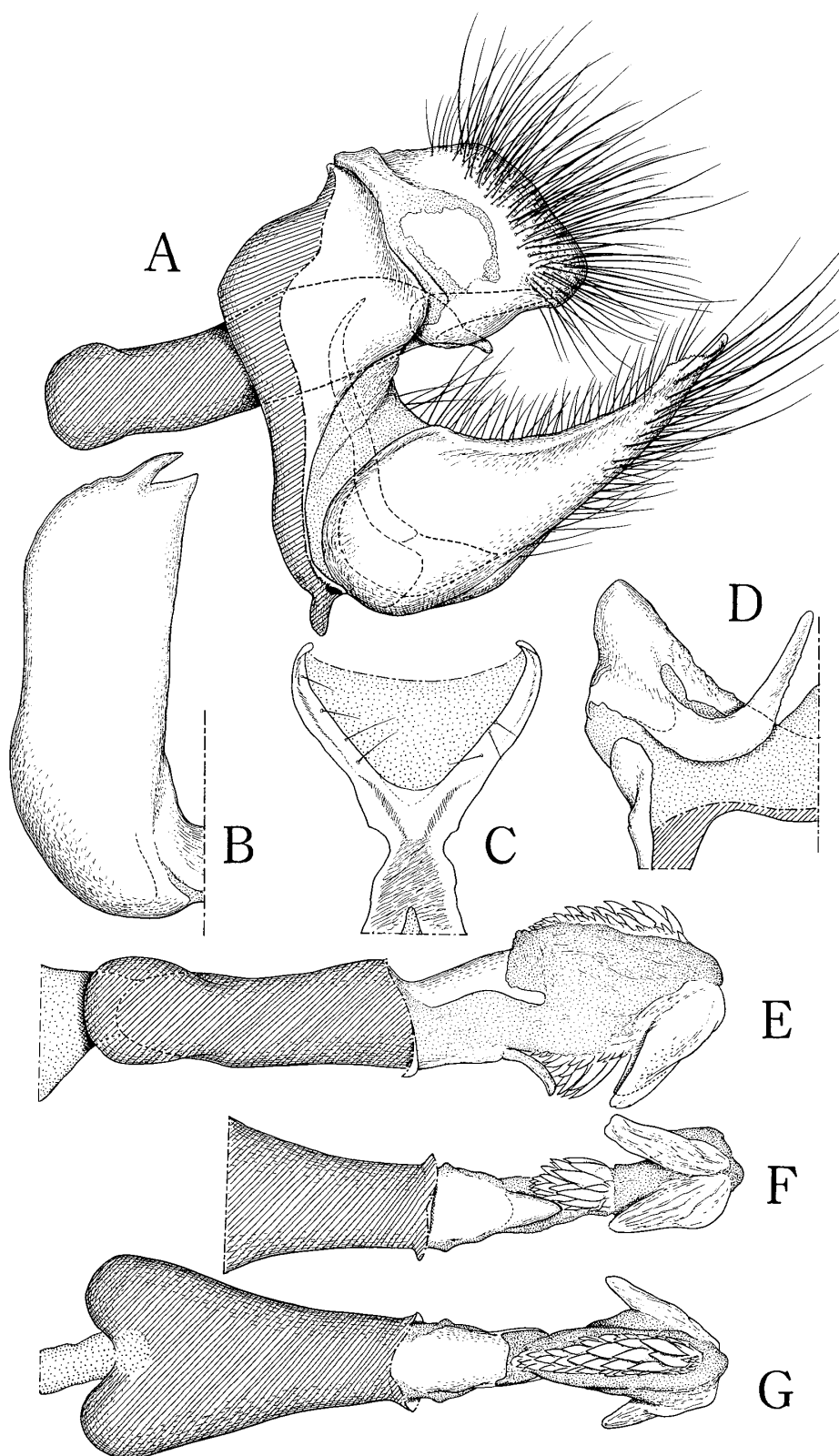


Fig. 34. *M. rebeli* (Hirschke, 1904), Poland, Katy, 15. vii. 1984 (Palik), AS.

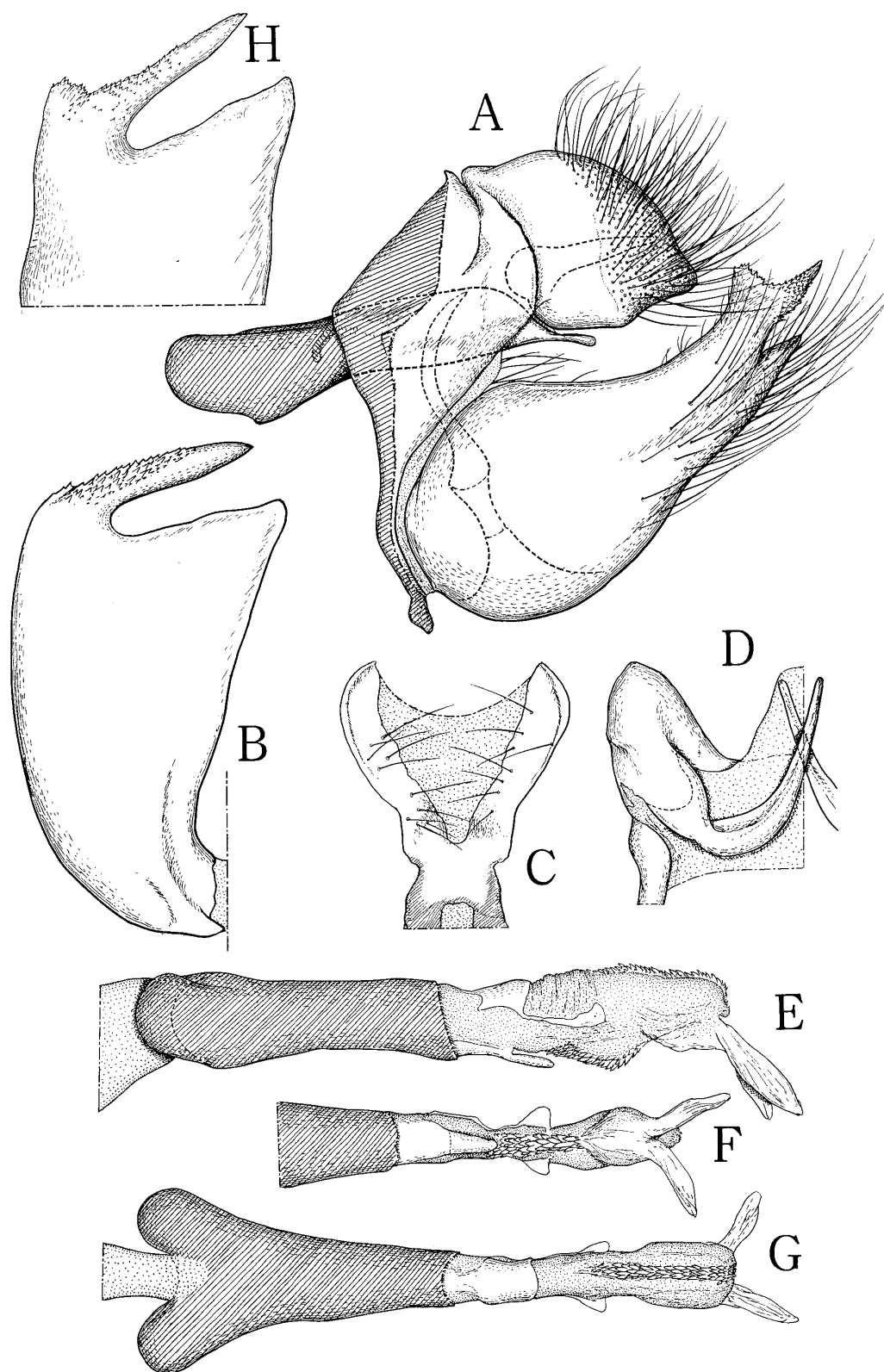


Fig. 35. *M. arion arion* (Linnaeus, 1758), Switzerland, Mulgens, 29. vii. 1989 (Sibatani), AS.

**C. *Maculinea arion xiaheana* (Murayama, 1991), stat. nov.**

(Figs 6, 7 ♂♂; 8 ♀; 31 J, K androconia; 36 male genitalia)

*Glaucopsyche xiaheana* Murayama, 1991: 21, fig. 5 (♂) (Central China).*Maculinea xiaheana*?: D'Abrera, 1993: 484-485, fig. (holotype).

Type. Holotype ♂, CHINA labelled (in Japanese) "Gansu 甘肅 Province Xiahe 夏河, 3,200-3,500 m, 20. vii. 1989, S. Murayama [not leg.]", SM (examined).

Other material examined. 4 ♂ 1 ♀ with label data the same as the holotype, but the altitude is 3,300 m except for 1 ♂ which has no altitude datum.

FL. ♂: 14.0-15.5 mm, 17.0-19.0 mm, ♀: 17.0 mm.

Holotype and another ♂ are much larger than the rest of the material, but still smaller than most specimens of *inferna* nom. nov. (see below). ♂ dorsal surface not very strongly shining blue almost to the termen with narrow dark margin on FW and row of terminal spots on HW, and suffused with whitish scales along termen especially on HW; veins dark; FW always with well marked cell end bar but generally with reduced postmedian spots, especially on HW, which are quite variable and sometimes completely absent as in holotype. Ventral surface grey brown with varying dark shade, on HW suffused widely with light green or darkish blue-green scales, often to series of subterminal spots, some-times quite densely; postmedian spots variable, sometimes almost completely absent like in holotype; however, in one individual they are quite well marked but with somble bluish suffusion limited to proximal half of the HW (Fig. 7). Wings are not particularly narrow; fringes white, looking slightly scalloped ventrally.

Androconia. Generally darker, smaller and more elongate than those of *arion* from Europe. Frequency as well as the number of ribs is not significantly different from *arion* (s. str.).

Genitalia. Both male and female (Fig. 36) are not significantly different from those of *arion* (s.str.) as well as *ussuriensis* (Fig. 35). Murayama's (1991) original figure of the male genitalia of holotype does not significantly differ from our observed material.

Murayama's (1991) description as *Glaucopsyche xiaheana* of a single ♂ (holotype FL 19.0 mm) shows that it agrees well with the original description of *M. arion tatsienluica* (Oberthür, 1910) (= *inferna* nom. nov.; see below) from Tibet. Illustrating the holotype of *xiaheana* as a *Maculinea* species, D'Abrera (1993: 484) noted 'Prof. Murayama has attached a note about the above taxon, he has apparently [ ] re-named *xiaheana* as follows: = "*Lycaena*" *arion tatsienluica* Oberthür, pre-occupied by "*Lycaena*" *pheretes tatsienluica* Oberthür.' Actually Murayama has not renamed *xiaheana* in publication as above. In fact, *xiaheana* and *tatsienluica* are distinct taxa from different type localities, only to be synonymized subjectively by appropriate action. Hence we give a replacement name for the latter as below. The main features of *M. arion tatsienluica* (Oberthür, 1910) are spotless extended blue ground colour almost to the termen on the dorsal surface like *alcon*, reduction of postmedian spots on the ventral surface especially of the HW, and strong light metallic blue-green suffusion all over the ventral HW, a feature indicating similarity with *cyaneacula* as mentioned above.

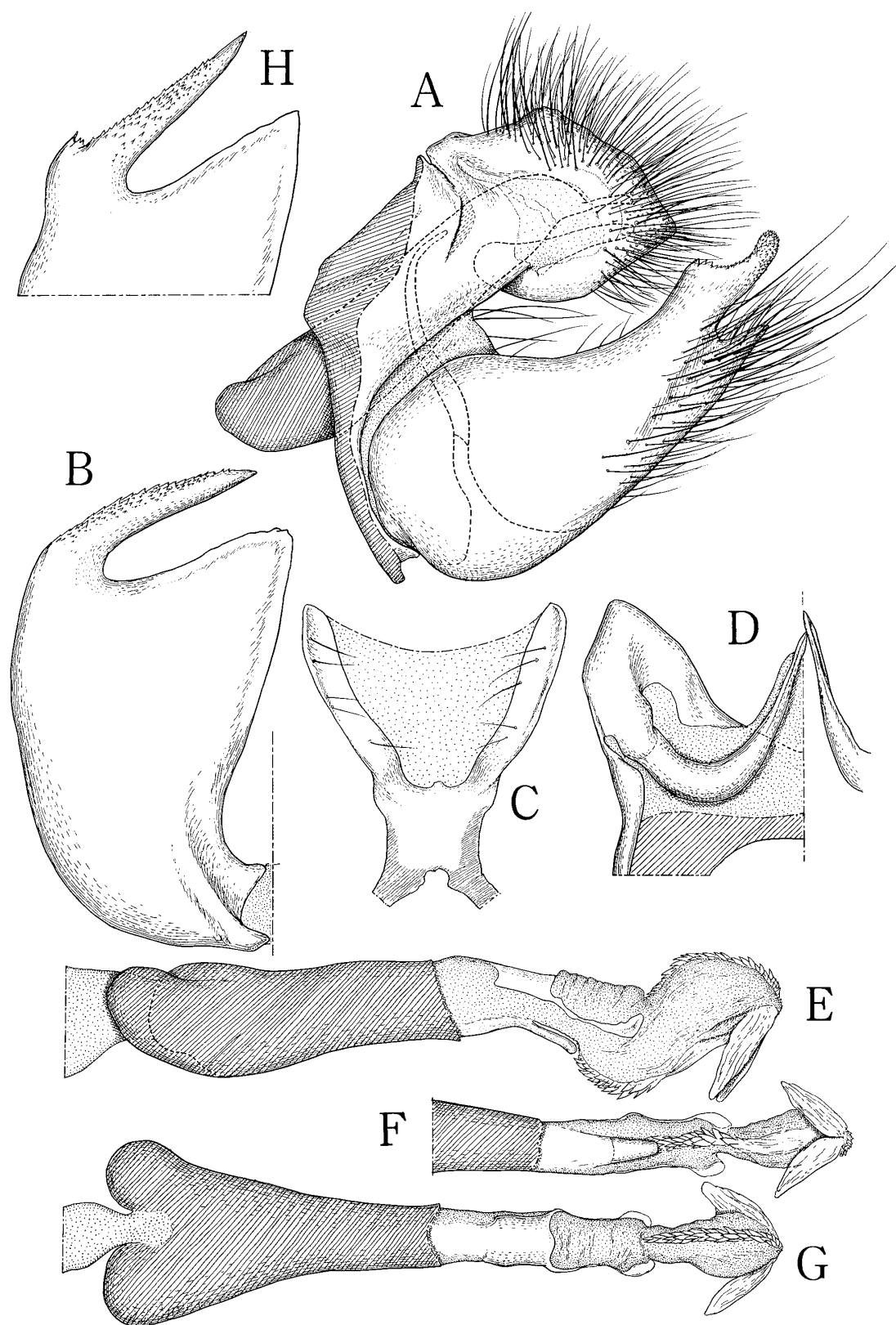


Fig. 36. *M. arion xiaheana* (Murayama, 1991), China, Gansu, Xiahe, 20. vii. 1989, MS.

There is a possibility that the holotype of *xiaheana* (Fig. 6) is a larger-than-average specimen of the local population, because 4 out of 5 other specimens (but not paratypes) including a ♀ (Fig. 8) from the same locality of Xiahe, Gansu, are of much smaller size (♂ : 14.0–15.5 mm, ♀ : 17.0 mm), even smaller than most other *Maculinea* taxa. The 4 ♂ specimens examined, probably collected at the same area and at the same time, show another deviating feature from the holotype to various extent: the reduction of the postmedian spots on both surfaces of both wings is variously incomplete, as shown in Figs 7 and 13. One ♂ (Fig. 7) shows a complete set of these spots. The position of these spots thus revealed is similar to that of *M. arion*. In all of them, like in holotype, the cell end bar on the dorsal FW is quite large and conspicuous. The exceptional ♂ (Fig. 7) mentioned above also has the dull and reduced bluish suffusion on the ventral HW, thus resembling a ♂ of “*philidor*” from the Qilian Range (Fig. 27). The only ♀ from the type locality has a dull blue area in the proximal 2/3 of the dorsal FW, with dark cell end bar and postmedian series of small spots. The ventral surface is similar to ♂, but the blue suffusion is rather sombre and limited in expansion. This agrees with the original description of ♀ by Oberthür (1910) of *tatsienluica* except for the apparent absence of blue area in his specimens from Tibet.

Along with D'Abrera (1993) we place *xiaheana* in *Maculinea*. Although Murayama (1991) (but see D'Abrera, 1993) did not mention the relation of this taxon to what was known as *Maculinea arion tatsienluica* (Oberthür, 1910) = *inferna* nom. nov. (see below), the original description of *tatsienluica* seems to agree with the holotype of *xiaheana* rather well. Because of the allopatry of *inferna* and *xiaheana*, we refrain here from synonymizing *inferna* to *xiaheana* until types of *tatsienluica* (Oberthür, 1910) and other specimens from type localities of the two taxa can be directly compared.

Life history. Totally unknown.

Distribution. Central China, highlands of Gansu above 3,000 m.

#### D. *Maculinea arion inferna* nom. nov.

(Fig. 13, ♀)

*Lycaena arion tatsienluica* Oberthür, 1910 : 328 (Tibet<sup>2</sup>); Bollow, 1931 : 294 (Tibet). Invalidated by Bridges (1988 : 341) as a junior primary homonym of *Lycaena orbitulus tatsienluica* Oberthür, 1910 : 298, but a replacement name not proposed.

*Maculinea arion* : Nose, 1990 : 131, figs 15 (♂), 16 (♀) (Dege 德格 [= Derge] County, Sichuan 四川, alt. 3,900 m, near Tibetan border).

“Goozan-goma-sizimi” [= *Maculinea arion* (Linnaeus, 1758)] : Watanabe, 1993 : 231 (photo a ♂ in the field) (near Kumbun [= Kubum] Monastery west of Huangzhong 湟中, Qinghai, alt. 2,800 m).

<sup>2</sup> Eastern part of Tibet (or Xizang 西藏) was removed by the new Government of People's Republic of China in 1949 to become part of the traditional Chinese provinces of Gansu, Qinghai and Sichuan. Scientific records made before that year should now be analysed accordingly. In the case of the present taxon, the reference in species group's name to Tatsienlu (currently called Kangding 康定 or Dardo (?=Dartsedo) indicates its type locality being in the present Province of Sichuan. Similarly those localities we mentioned above, or will mention below, in relation to *philidor* (Tianzhou, Gansu), *xiaheana* (Xiahe, Gansu), *inferna* (Dege, Sichuan; Huangzhong and Kumbun, Qinghai) and *sinalcon* (Huangzhong, Qinghai) were apparently once within the territory of Tibet as was called in Europe and Japan (cf. Department of Information and International Relations of His Holiness the XIV Dalai Lama, 1992).



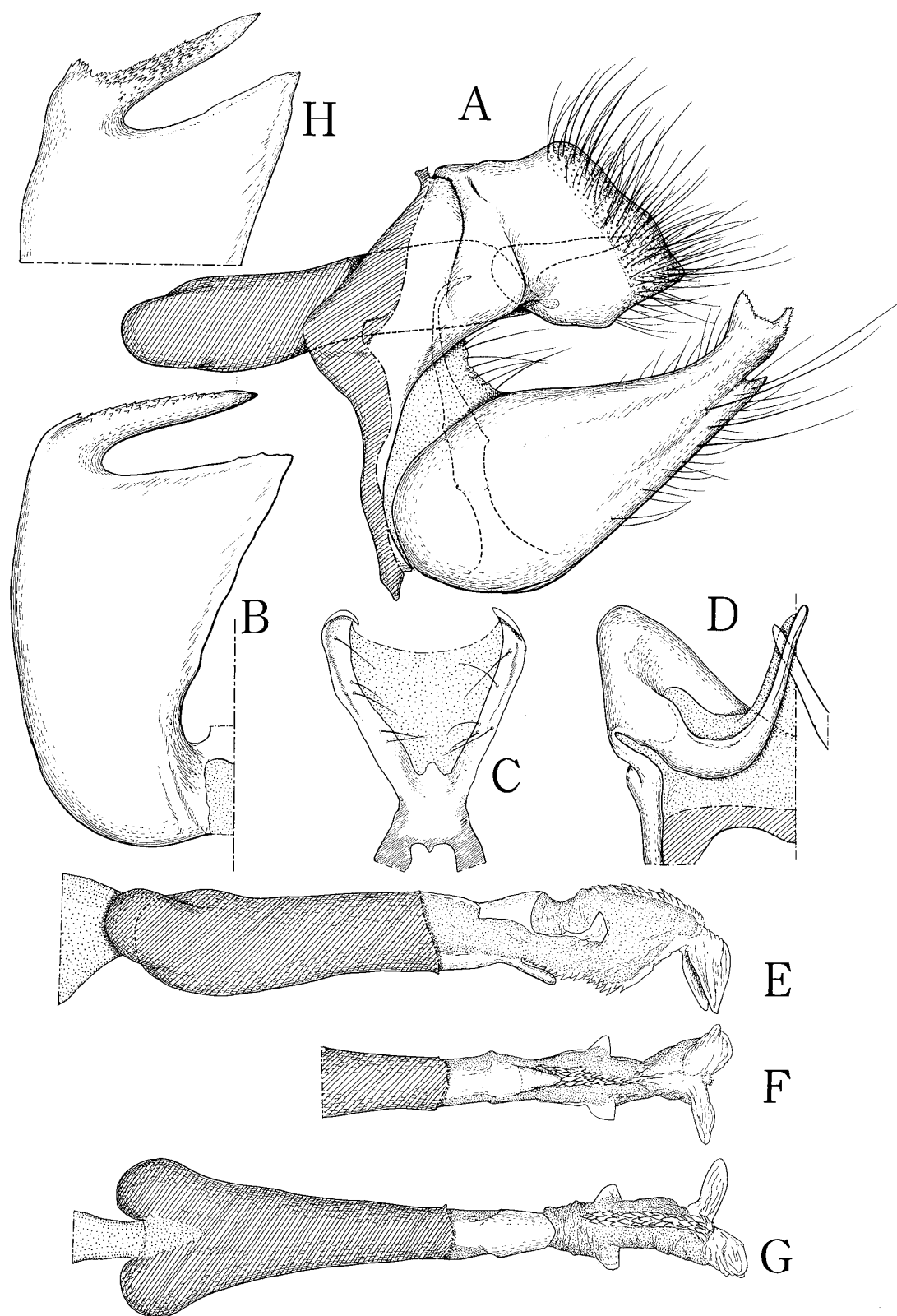


Fig. 37. *M. arionides arionides* (Staudinger, 1887), Russia, Primor'e, Ussurisk Reserve, 27. vii. 1990 (Sibatani), AS.

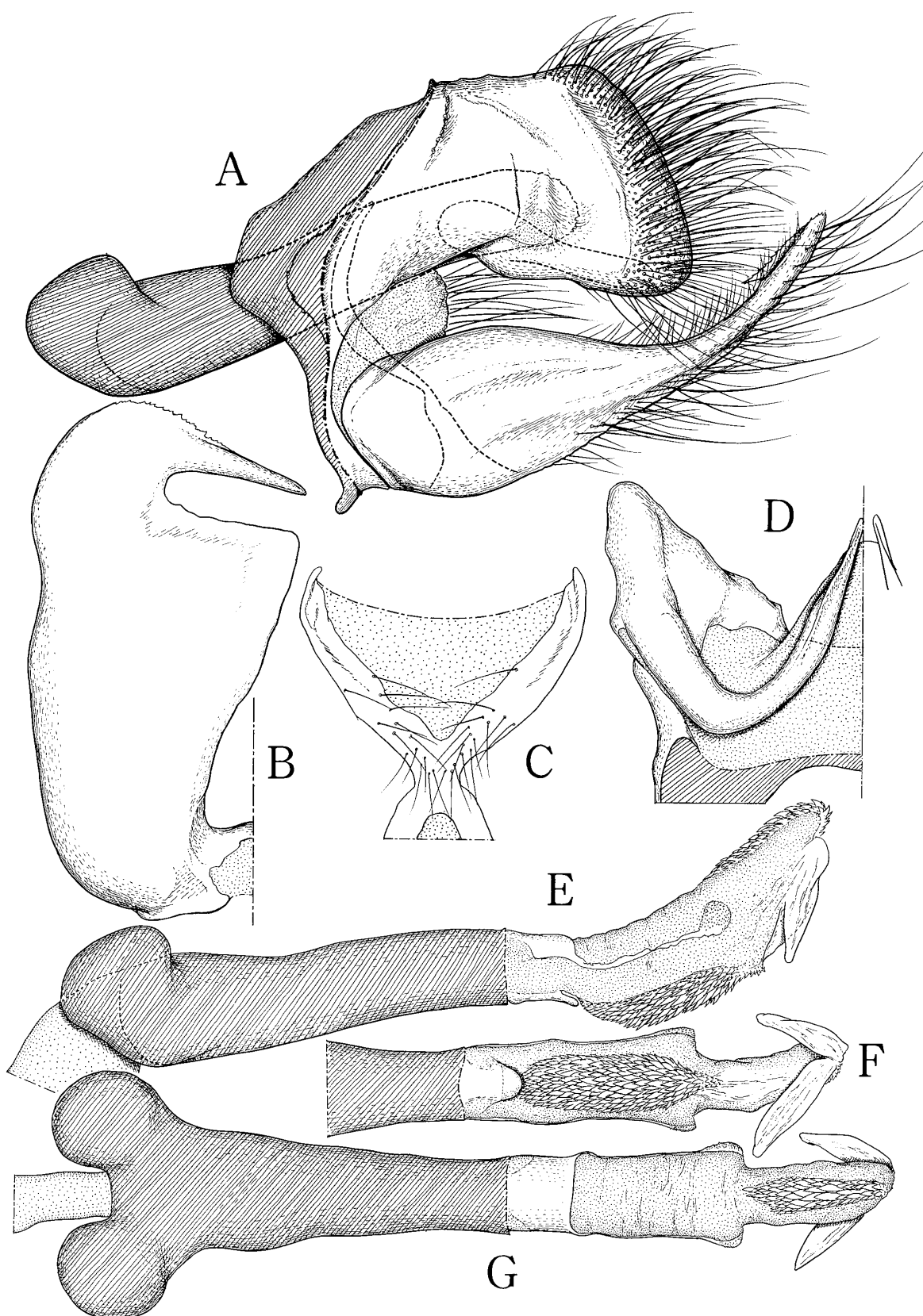


Fig. 38. *M. teleius euphemia* (Staudinger, 1887), Russia, Primor'e, Vityaz Bay, 1. viii. 1990 (Sibatani), AS.

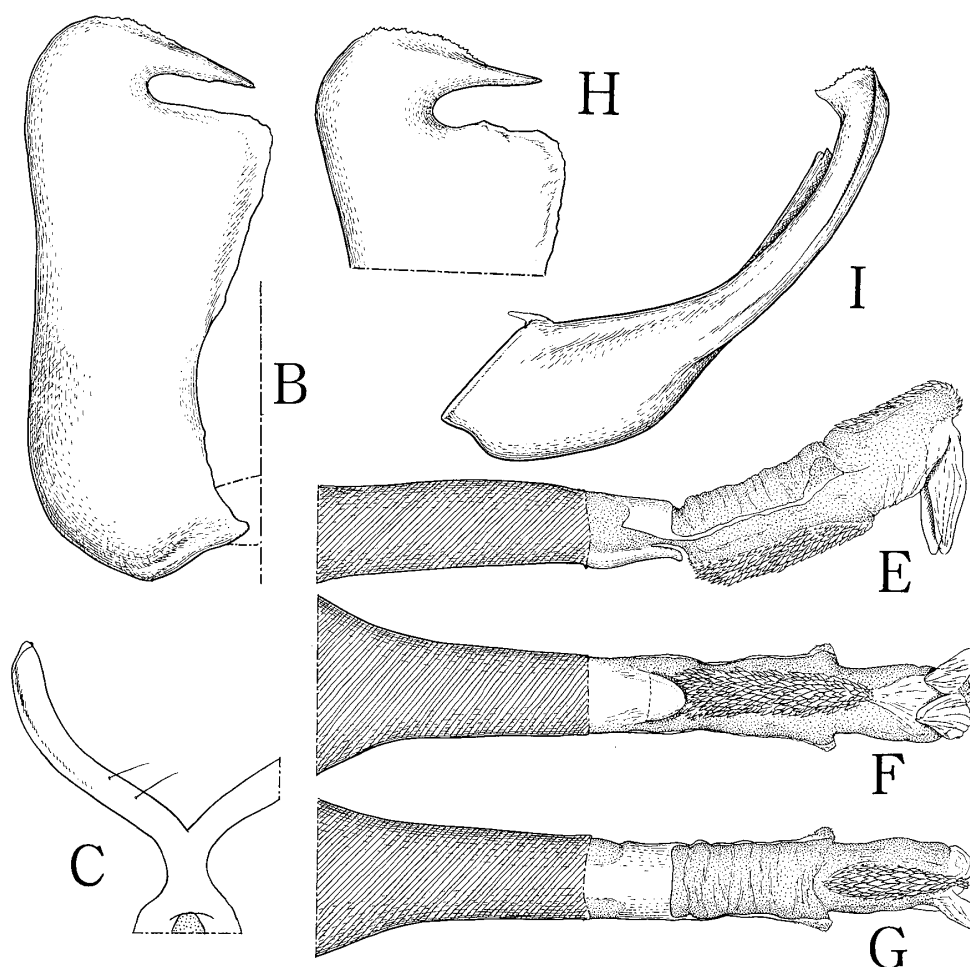


Fig. 39. *M. teleius sinalcon* Murayama, 1992, holotype, dorsal portion (lost) is not represented.

As mentioned above (p. 182), we give a replacement name *inferna* for the invalid *Lycaena arion tatsienluica* (Oberthür, 1910) from "Tibet" (see footnote 2; probably western Sichuan). Bridges (1988) acted as the first reviser in this case, who invalidated *Lycaena arion tatsienluica* Oberthür, 1910 : 328, without proposing a replacement name, as a homonym of *Lycaena orbitulus tatsienluica* Oberthür, 1910 : 298, the two names appearing in the same publication on the same date.

We have seen, in various collections made recently in China, what might tentatively be identified as *inferna*. They might be distinguished from the typical *xiaheana* mainly because of their size (FL about 20 mm). Even a ♂ specimen collected at the type locality of *xiaheana* (Fig. 7) (Xiahe, Gansu) may be regarded to be approaching *inferna*, except for the lack of strong lustre of blue on the dorsal surface which is a characteristic of *inferna*.

Material examined. CHINA—Qinghai Province: Huanzhou (=Huangzhong?) 1 ♀, MS; Taer Monastery near Huangzhong, alt. 2,800-3,000 m, 2 ♂, 19. vii. 1991, 3 ♂ 1 ♀, 19. vii. 1992 (Watanabe), KS.

FL. ♂♂ 15.5 mm, 17.0-23.6 mm, ♀♀ 22.0-22.1 mm.

Very similar to the subspecies *xiaheana* from west Gansu, especially in ♂. Generally much larger than *xiaheana*, and the light blue ground colour on ♂ dorsal surface has a strong

lustre whereas in *xiaheana* it is paler and much less shiny ; as in *xiaheana*, the bluish green suffusion on ventral HW rather variable in tinge and extent, its expanse being from proximad of cell end bar to reaching subterminal spots ; extent of reduction of postmedian spots on both surfaces quite variable from almost none to like those of *philidor*.

♀ : The blue colour of dorsal FW extended to postmedian spots, well revealing the strongly marked postmedian spots (Fig. 13 as well as Fig. 16 of Nose, 1990 : 131), whereas in the only *xiaheana* ♀ examined the blue area extends distad of postmedian spots which are rather weakly marked.

In sum, specimens from NW of the present Sichuan Province near Tibetan border stand close to the ones from Qinghai near the Gansu border, so that they may be lumped together and must have been recorded as coming from the former Tibet. We therefore apply the new name *inferna* (replacing *tatsienluica* from "Tibet") to these populations, and would not assign *inferna* to the present Province of Xizang of China. However, this action makes the border area of Gansu and Qinghai Provinces densely crowded by representatives of three subspecies : *philidor*, *xiaheana* and *inferna* (Fig. 30B). Further analyses will be needed to settle the question concerning the variability and subspecific identity of each local population in the central west of China, including the identity of *nepete* (Fruhstorfer, 1915) which could not be dealt with properly in this paper.

Life history. Totally unknown.

According to Watanabe (1993), the east Qinghai population near Huangzhong was found commonly in July near ridges of the meadow just above the cultivated area behind the township of Huangzhong. The butterflies flew rather briskly, seldom settling ; ovipositing behaviour of the female was not observed ; neither was the possible foodplant, *Thymus mongolica*, known from the area. The habitat was a grassland mixed with bushes with plenty of butterflies including *Pyrgus* spp., *Carterocephalus* sp., *Colias* spp., *Melanargia epimede*, *Coenonympha* spp., *Aphantopus hyperantus* and *Clossiana gong*. Since the area is extensively cultivated, it would not be very dry, so that the habitat near Huangzhong of *arion inferna*, which belongs to the *cyanecula* group of *arion* subspecies, may undermine the definition of *Maculinea cyanecula* by Bálint (1990).

Distribution. W Sichuan and Qinghai (all formerly Tibet).

### 3. *Maculinea arionides* (Staudinger, 1887)

(Figs 16 adult ; 30C map ; 31R, S androconia ; 37 male genitalia ; 47 female genitalia)

This taxon is totally missing in D'Abrera's (1993) treatise of Palearctic butterflies. In E Asia there are two subspecies with fairly obvious differences.

#### A. *Maculinea arionides arionides* (Staudinger, 1887)

(Figs 16 ♂ ; 31R androconia ; 37 male genitalia)

*Lycaena arionides* Staudinger, 1887 : 141, pl. 7, figs 1a, c(♂), 1b (♀) (Vladivostok, Ussuri) ; Sugitani, 1934 : 168-172, pl. 14, fig. 7 (♂) (N Korea) ; Kurentzov, 1970 : 142-143, figs 21 (♂), 22(♀) (mid-Amur River, Primor'e, Manchuria and Korea).

*Lycaena arionides arionides* : Mori, Doi & Cho, 1934 : 51.

*Maculinea arionides* : Lee, S.-M., 1982 : 38, figs 85C, D (♂), A, B, E (♀) ; Lee, C.-L., 1982 : 150 (Jiangda 江達, Xizang 西藏) ; Shin, 1989 : 35, 57, 171, no. 72 (♂♀) (S Korea) ; Park, 1987 : 93-95 (early stages, N

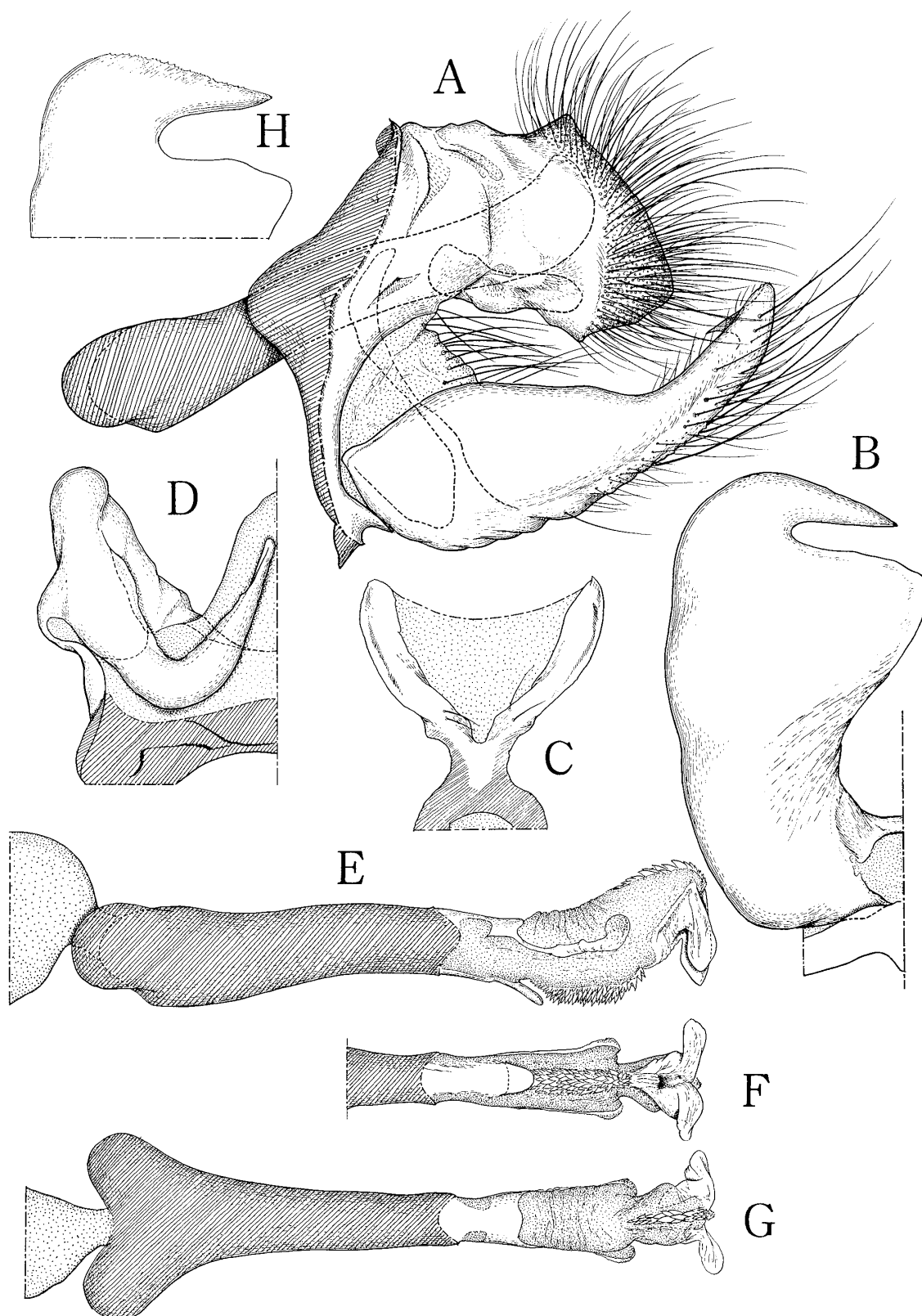


Fig. 40. *M. kurentzovi* sp. nov., paratype, Russia, S Primor'e, near Krounovka, 29. vii. 1990 (Sibatani), MS.

Korea); Shin, 1991: 89, 248-249, figs (♂ ♀); Lee, S.-M., 1993: 23 (Manchuria).

*Maculinea arionides arionides*: Inomata, 1982: ix.

*Lycaena arionides sugitanii* Matsumura, 1927b: 118, pl. 3, fig. 10 (♂) (Korea: "Kongôsan" [=Kumgang-san 金剛山]); Matsumura, 1931: 554, no. 321 (♂); Mori, Doi & Cho, 1934: 51, pl. 26, fig. 2 (♂); Sugitani, 1934: 168-172, pl. 14, fig. 6 (♂), textfig. 2 (♀); Bollow, 1931: 295. Syn. by Kurentzov (1970), as f. *sugitani*! and by Inomata (1982).

*Maculinea teleius*: Lee, S.-M., 1982: pl. 22, fig. 87E ([♂], as ♀) (Gangweon-Do 江原道, Mt. Seolag-san 雪岳山), probably nec Bergsträsser, [1779] 1778-1780.

Material examined: RUSSIA—Primor'e, Ussurijsk Reserve, 1 ♂, 27. vii. 1990; River Puksibichan, 25 km SSW of Krounovka, ca. 50 km SW of Ussurijsk, 1 ♂, 28. vii. 1990 (A. Sibatani), AS; 3 ♂ 1 ♀, 29. vii. 1990 (T. Saigusa), KUB; Vladivostok Botanic Gardens, 1 ♀, 5. viii. 1990 (T. Saigusa), KUB. KOREA—Hamgyongbuk-Do 咸鏡北道 "Kwainei" [=Hoeryong 会寧], 1 ♀, 31. vii. 1933 (I. Sugitani): "Kwanbôhôt" 冠帽峰 [=Kwanmo-san], 1 ♂, 20. vii. 1933 (I. Sugitani); Gangweo-Do 江原道, Kongosan [=Mt. Kumgang-san], 2 ♂ 1 ♀, 7. viii. 1935 (K. Takeuchi), UOP.

FL. ♂♂ 21.1-25.5 mm, ♀♀ 23.5-27.2 mm

♂ blue colour of dorsal surface often light and extensive, on HW almost reaching termen, revealing submarginal spots; ♀ dorsal blue area generally limited; fringes in either sex completely white or only vestigially scalloped.

Androconia. Basically indistinguishable from those of *arion* in morphology but the frequency may be fairly low (Tables 1 & 2).

Genitalia. Male genitalia (Fig. 37) show virtually no difference from those of *M. arion* and subsp. *takamukui* below. Female genitalia have been examined, but failed to show significant differences from subsp. *takamukui*: for specific differences, see *M. arionides takamukui* (Matsumura).

Distribution. Middle part of Amur River, Primor'e, SE part of China NE (Manchuria), northern, central and southern regions of Korean Peninsula and eastern Xizang 西藏 (3,400 m). Quite variable in each locality; hence the subsp. *sugitanii* proposed for a gigantic form of Korean populations was sunk as a subjective synonym by Kurentzov (1970) and Inomata (1982).

Life history. Early stages have been partially described by Park (1987).

## B. *Maculinea arionides takamukui* (Matsumura, 1919)

(Figs 31S androconia; 43 female genitalia)

*Lycaena arionides*, var. *takamukui* Matsumura, 1919: 3: 653, pl. 49, fig. 32 (♀) (Nagano-ken: Simosuwatyuô, Higasimata).

*Maculinea arionides takamukui*: Fujioka, 1975: 151, pl. 69, nos 49-91 (♂♂ ♀♀); Kawazoé & Wakabayashi, 1976: 115, fig. 17 (androconium), 154-156, pl. 33, figs 2a-c (♂♂ ♀♀); Fukuda, *et al.*, 1984: 266-269, pl. 51 (♀, life history); Inomata, 1986: 131, 265, 404, 428, pl. 47, figs 175-201 (♂♂ ♀♀); Inomata, 1990: 114-115, figs 938-943 (♂♂ ♀♀).

*Maculinea arion takamukui*: Esaki, 1923: 457, figs 6-9, 19, 20 (♂♂ ♀♀).

*Maculinea arionides* Matsumura!: Yamaguchi, 1988: 78-116, 250-252, figs (♂♀, life history).

*Lycaena arion shiranensis* Scriba, 1921: 25, figs 1, 2 (♂♀) (Nikko, Shirane). Syn. by Esaki (1923), and Bollow (1931) as *Scriba*!

*Lycaena euphemus kazamoto*: Miyajima, 1899: pl. 19, fig. 2 ([♀], as ♂); Miyajima, 1900: 11, partim nec

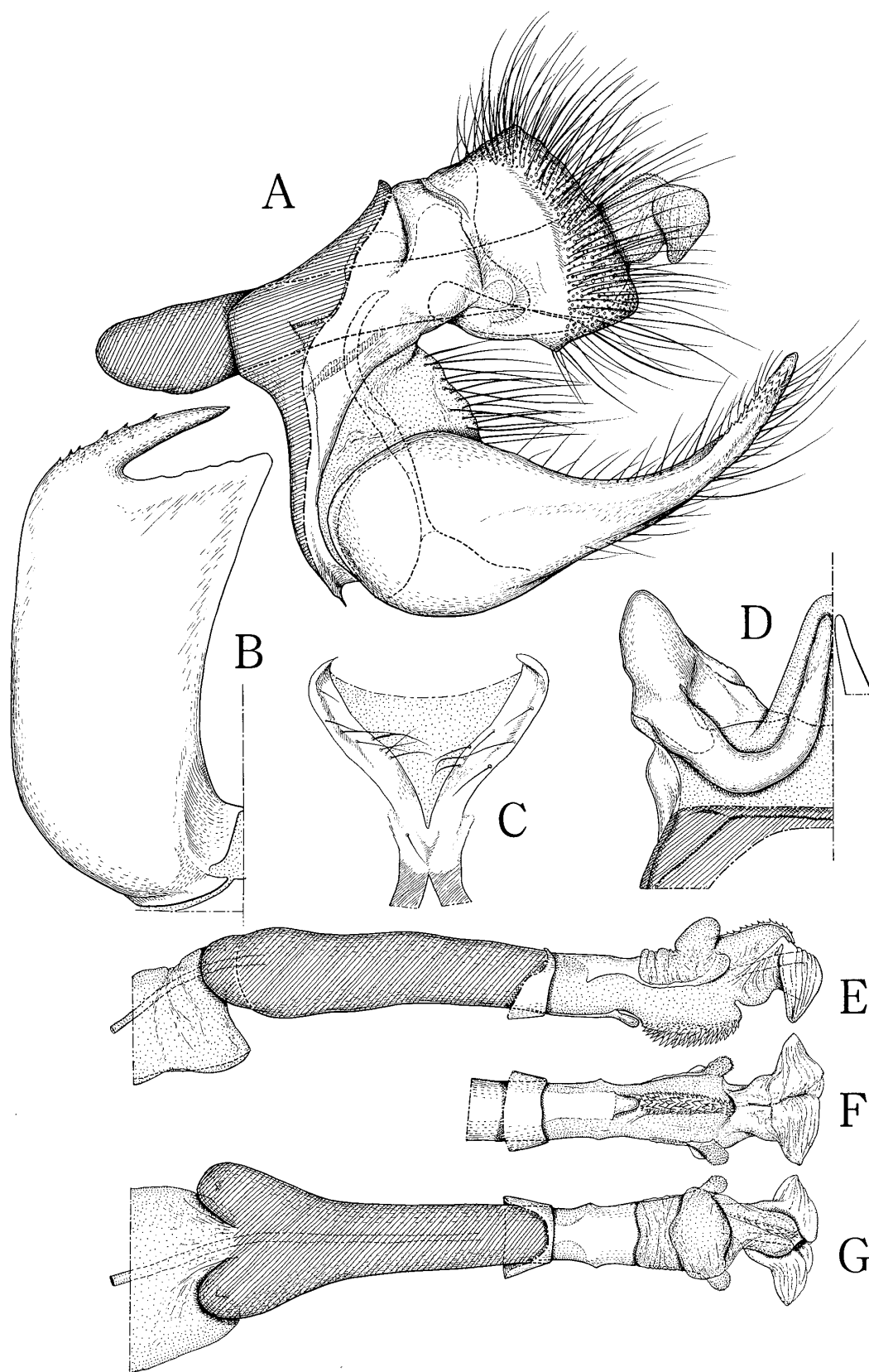


Fig. 41. *M. nausithous* (Bergsträsser, [1779] 1778-1780), Slovakia.

H. Druce, 1875.

*Lycaena euphemus*: Miyajima, 1904: pl. 18, fig. 9 ([♀], as ♂), partim nec Hübner, [1780].

Material examined: JAPAN—Nagano-ken, Kita-arupusu, 1 ♂, 25. vii. 1964 (Oshima), AS; Kamikôti, 1 ♀, 15. viii. 1936 (Takeuchi), UOP; Abô-Tôge, 1 ♀, 15. viii. 1951 (S. Ito), UOP.

FL. ♂ 20.5 mm, ♀ ♀ 22.5–23.0 mm.

Smaller than *arionides* (s. str.), wings shorter, more rounded: ♂ dorsally with wider black margins, fringes definitely scalloped. ♀ dorsal blue area extends distad of postmedian spots on FW. Some specimens from Hokkaido approach *arionides* (s. str.) in their variation.

Genitalia. Male: Genitalia do not differ significantly from those of *arionides* (s. str.). Female: Ventral sclerite of 6th abdominal segment rectangular or ellipsoidal,  $0.90\text{--}0.92\times$  as long as lodix. Lodix nearly quadrate, slightly dilated caudally. Apophysis anterioris short, acuminate,  $0.11\times$  as long as 8th tergum. Cavities of intersternal membrane shallow, situated more closely to each other than in *arion*; caudal ridge nearly straight and distinct. Genital plate tongue-shaped as in *arion*, rather strongly bent dorsad, with a single swelling at dorsal base; ventral surface with a distinct median ridge. Ductus bursae not widened at caudal portion. Eighth abdominal venter moderately haired, somewhat dense and long at subventral areas. Papilla analis relatively small and weakly built,  $0.36\text{--}0.39\times$  as long as 8th tergum. Apophysis posterioris long and slender. The species difference between *arion* and *arionides* may be formulated as follows: In *arion*, the cavities of intersternal membrane are more definitely separated than in *arionides* and other species of the genus; however, shape of the cavities varies individually. The only reliable character to distinguish these two species is seen in the structure around ostium, including the shape of genital plate. In both species, the genital plate is tongue-shaped and slightly bent dorsad; in *arionides*, it is more strongly bent than in *arion*. In *arion*, three small weak swellings are present at dorsal base just behind the ostium, but in *arionides*, a single swelling is present in the same position. In *arionides*, ventral median keel is more distinct than in *arion*.

Life history. The early stages were partially documented by Fukuda *et al.* (1984) and later fully by Yamaguchi (1988). The host plant of young (up to 3rd-instar) larvae is *Isodon kameba* and *I. trichocarpus* (Labiatea), and the host ant of grown-up (4th-instar) larvae is *Myrmica rubra* (or rather a related unidentified species) and also *Aphaenogaster japonica*, the latter being added as a new host genus to *Maculinea* by Yamaguchi (1988), who also records this same ant at the host of *Maculinea teleius*, so that the general principle of exclusively specific association between each *Maculinea* species and each *Myrmica* species (Thomas & Elmes, 1989) is being challenged. Otherwise, the lifestyle of *takamukui* is quite similar to the pattern in other *Maculinea* species found in Europe.

Distribution. Japan (Hokkaido and northern half of Honsyû).

#### 4. *Maculinea kurentzovi* sp. nov.

(Figs 9 ♂; 10 ♀; 18–19 ♂♂; 20–24 ♀♀; 30D map; 40 male genitalia; 43, 44 valvae; 48, female genitalia)

*Lycaena euphemus hozanensis*: Mori, Doi & Cho, 1934: 52, pl. 25, figs 9 (♀), 10 (♂) (northern, western and central Korea), nec Matsumura, 1927.



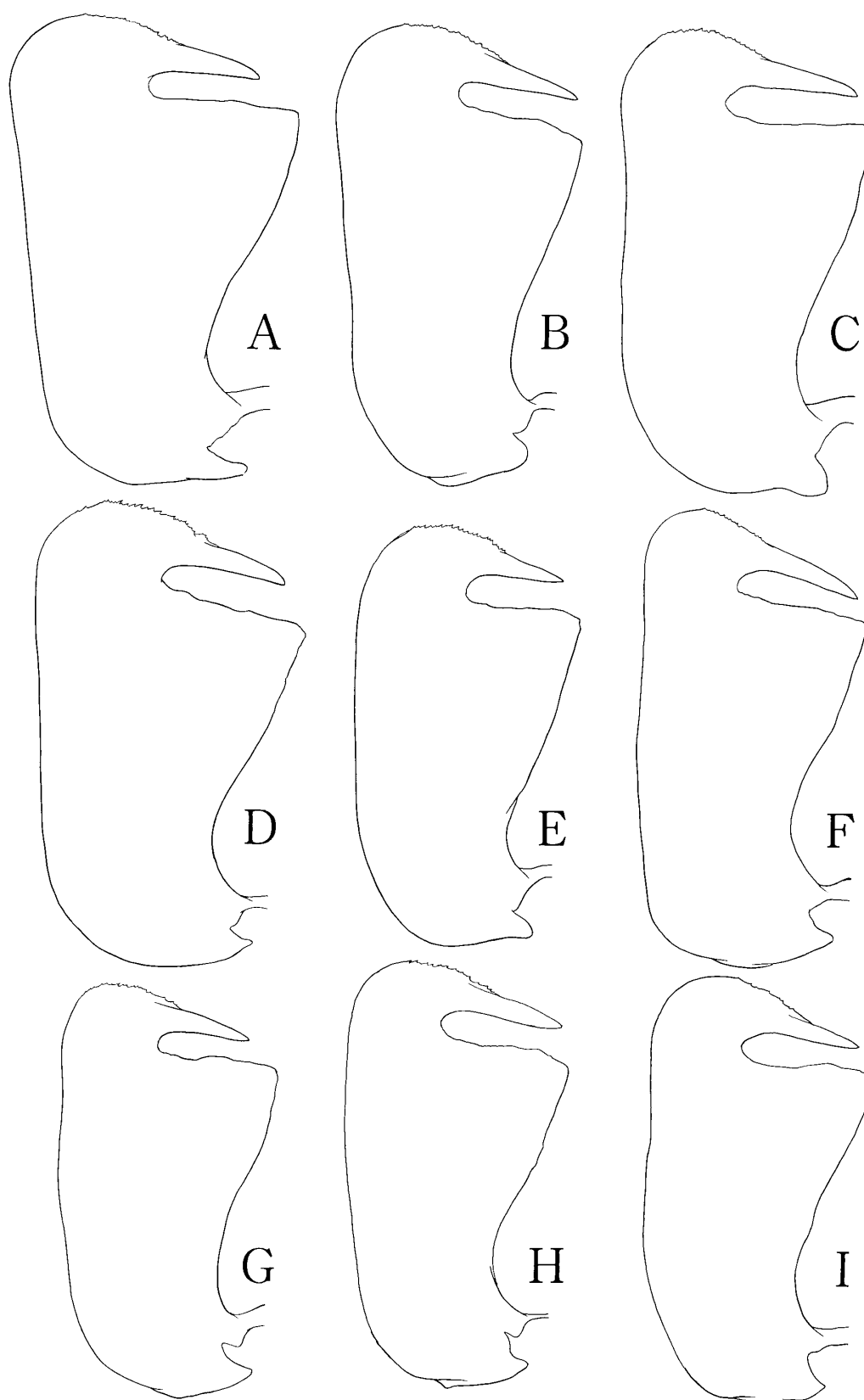
*Maculinea teleius hozanensis*: Lee, S.-M., 1993: 23 (E Manchuria), nec Matsumura, 1927.

*Lycaena kondakovi* Kurentzov, 1970: 142 (♀ paralectotype here designated) (Primor'e: Upper part of Suchan[g], Sozyô 蘇城 [=Partizansk] River), partim.

Types. Holotype, ♂. DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA—Ryanggang-Do 兩江道: labelled “Kantairi [=Handaeri 漢岱里], 29. vii. 1939”, ex SM, KUB. Paratypes. 10 ♂ 9 ♀ (all examined): N KOREA—Ryanggang-Do: 3 ♂ 1 ♀, Hyesan [=Haesan; Keisan 惠山]-Paramtec 1,200 m, Poch'ombo [=Hutenhô 普天堡], 31. vii. 89 (E. Palik), ISEZ (1 ♂) and WE (2 ♂ 1 ♀), 1 ♀ Hyesan-Langdak 900 m, 30. vii. 1989 (E. Palik), ISEZ; 2 ♂, “Tônai, Hakugan” [=Paegam 白岩], 23. vii. 1933 (I. Sugitani), IS; Hamgyongbuk-Do 咸鏡北道: 1 ♀, “Kôsyô” [=Fuchang 厚昌], 14. vii. 1937, 1 ♀, “Zyôsin” [=Sungjin 城津], 16. viii. 1942, 1 ♀, Hakumo-kôgen [=Paekmu Koweon (Highlands) 白茂高原], Hokkeisui [=Pukkaesu 北溪水], 19. vii. 1942, all SM. RUSSIA—Primorskij Kraj: 1 ♀, paralectotype of *Lycaena kondakovi* Kurentzov, 1970 (=subspecies of *M. alcon*), labelled “13. viii. 31, Forest upper part of Suchan[g] 蘇城 (=Partizanskaya) River” (translated from Russian), as well as “[PARALECTOTYPE]/*Lycaena kondakovi*/Kurentzov, 1970/ designated by Sibatani,/ Saigusa et Hirowatari,/ 1994” (here designated); 2 ♀, Sikhote Alinskij Reserve, Ternei (Terney), 3. vii. 1964 (Volkava), all IBP; 1 ♂, Puksibichan 30 km SW of Krounovka and 50 km SW of Ussurijsk ca. 140 m, 29. vii. 1990 (A. Sibatani), SM; Chitaiskaya Oblast': 1 ♂, Chita [Shilka River of the Upper Amur], vi. 1920 (V. Tolmachov) ex Höne Collection, MAK. CHINA—China NE (Manchuria), Heilon-jian Province 黑龍江省: 1 ♂, Lahasusu at the merging point of Sungari/Songhua-Jiang 松花江 River with Heilong-jiang [=Amur River], vii. 1918, ex Höne Collection, MAK; 1 ♀, Hatahe 哈達河 [probably near Linkou 林口 (W of Hanka Lake)], 6. viii. 1938 (Okabe), KUB; 2 ♂, labelled “Yu-chan, Mand [=Yuchuan 玉泉 50 km SE of Harbin, Man(d)churia] 28. vii. 1938” (collector unknown), OMNH.

Holotype. ♂, FL 21.0 mm. Somewhat similar to *Maculinea teleius* (Bergsträsser) with which the species has often been confused, but it can be readily distinguished by several characters indicated below with asterisks. Dorsal wing surface dark brown with light blue scales filling disc from near wing base to subterminal zone except for areas near costa and dorsum, leaving ca. 3 mm-wide terminal dark band widening towards apex/costa; oblong black postmedian spots on FW from  $R_{3+5}$  to  $1A+2B$ , the one between  $CuA_1$  and  $CuA_2$  much shifted basad\* (cf. Figs 29A and B) and double markings in  $CuA_2-1A+2A$  much elongated, those on HW roundish, from costa to  $1A+2A$ ; cell-end bar represented by a strong crescent on FW, by a fine one on HW; areas of blue discernible between these spots and bases of intervenous spaces. Ventral surface ground colour light grey, slightly brownish but without basal bluish suffusion on HW; postmedian spots of FW in typical *Maculinea* pattern with the spot in  $CuA_1-CuA_2$  shifted proximad\* (Fig. 29A); three spots including this and those in  $M_2-CuA_1$  are thus not in line but form a shallow arc concave distad (difference from *alcon* where they are in a straight line; see Figs 29C and D); double spot in  $CuA_2-1A+2A$  as strongly marked as other postmedian spots\* whereas in other *Maculinea* species this spot tends to be weakly marked or even obscure; in FW cell, along cubitus just opposite to the base of  $CuA_1$ , there is a small spot, which forms discrete double spots with the other one above it, situated near radius, which is displaced basad of the lower one so that the two spots are in a line pointing to tornus (see Fig. 29A)\*. Submarginal spots well, but marginal spots less well, marked. Fringes white.

Paratypes. ♂♂, FL 18.0–21.0 mm. They vary in extent of blue coloration on dorsal



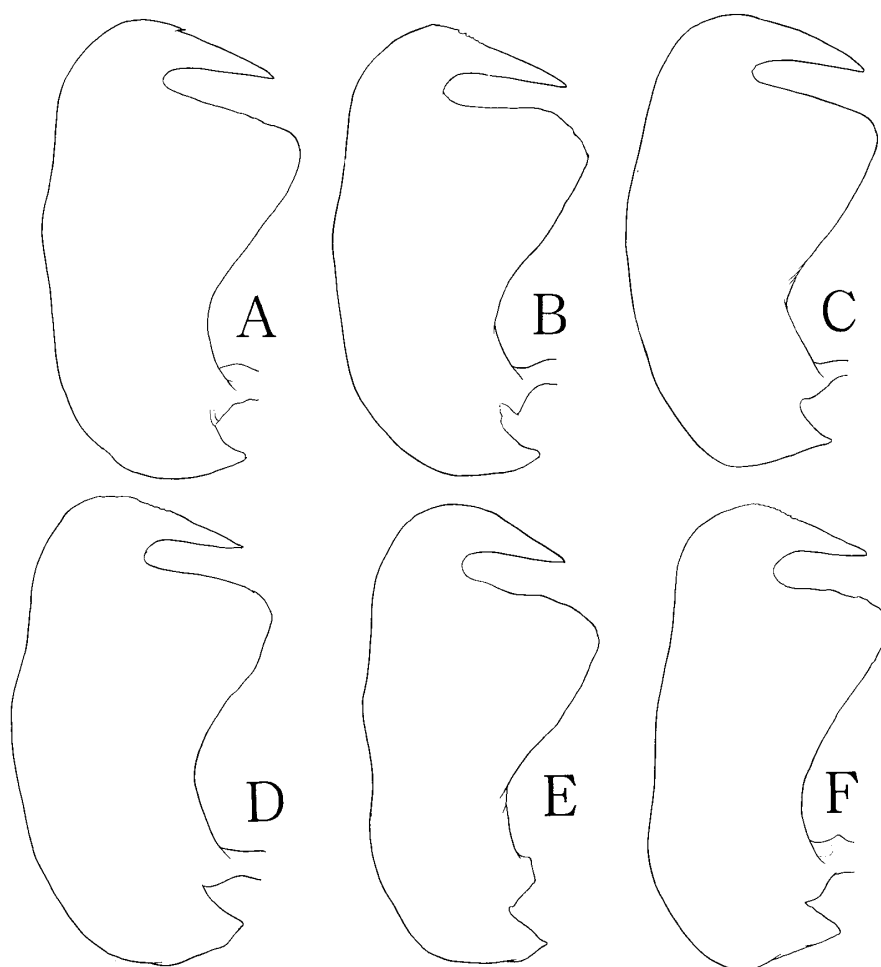


Fig. 43. Left valvae of *M. kurentzovi* sp. nov., ventral aspect. A-D. N Korea. A: Hyesan-Langdak, 30. vii. 1989 (Palik), ISEZ. B: as A, but 31. vii. 1989. C: "Tonai-Hakugan-Tyosen" [= Paegam], 23. vii. 1935 (Sugitani), IS. D: Holotype. E: S Primor'e, near Krounovka, 29. vii. 1990 (Sibatani), MS. F: Russia, Chita, vi. 1920, MAK.

surface; generally suffusion of blue scales prominent in disc, often less extensive than in holotype, not appearing distad of postmedian spots, but sometimes little or no blue scales discernible (Figs 23 and 24), especially on HW, leaving black postmedian spots barely discernible in cephalic half on FW and entirely on HW; both or either double spots in FW cell on ventral surface may be missing (Figs 20 and 21), often differing between the right and left wings.

♀ ♀, FL 17.3-22.2 mm. Dorsal surface variable as in ♂, sometimes almost uniformly dark brown, blue suffusion when present is usually paler than in ♂, often appearing as dull greyish markings distad of postmedian spots; ventral surface tends to be slightly darker

Fig. 42. Left valvae of *M. teleius* (Bergsträsser, [1779] 1778-1780), ventral aspect. A-C. Subsp. *euphemia*, S. Primor'e. A: Vityaz Bay, 1. viii. 1990 (Sibatani), AS. B: near Krounovka, 29. vii. 1990 (Saigusa), KUB. C: as A, but (Saigusa), KUB. D-G. Subsp. *euphemia*, N Korea. D: Mupo, 7. vii. 1985 (Palik), ISEZ. E: Hyesan, 31. vii. 1989 (Palik), ISEZ. F: Mupo, v-vii. 1985 (Kozielec), ISEZ. G: Taechong-dan, 8. vii. 1989 (Kozielec), ISEZ. H-I. Subsp. *teleius*, Poland, Kraków, AS.

in shade than in sympatric ♂♂. Otherwise as in ♂. Fringes even in dark specimens are, as in ♂, pure white, whereas in *teleius* fringes are brown in dark specimens and white in blue ones.

Variation is extensive in both sexes and on both wing surfaces, and it has so far not been possible to define local subspecies by wing patterning, dorsally completely dark specimens being obtained both from Korea and China NE and upper Amur River, although there is a tendency of the blue colour on the dorsal wing being significantly reduced or completely lost among specimens obtained from inland.

Androconia. Remarkably, males of this species are totally devoid of androconia in either dark or blue individuals (see Table 1).

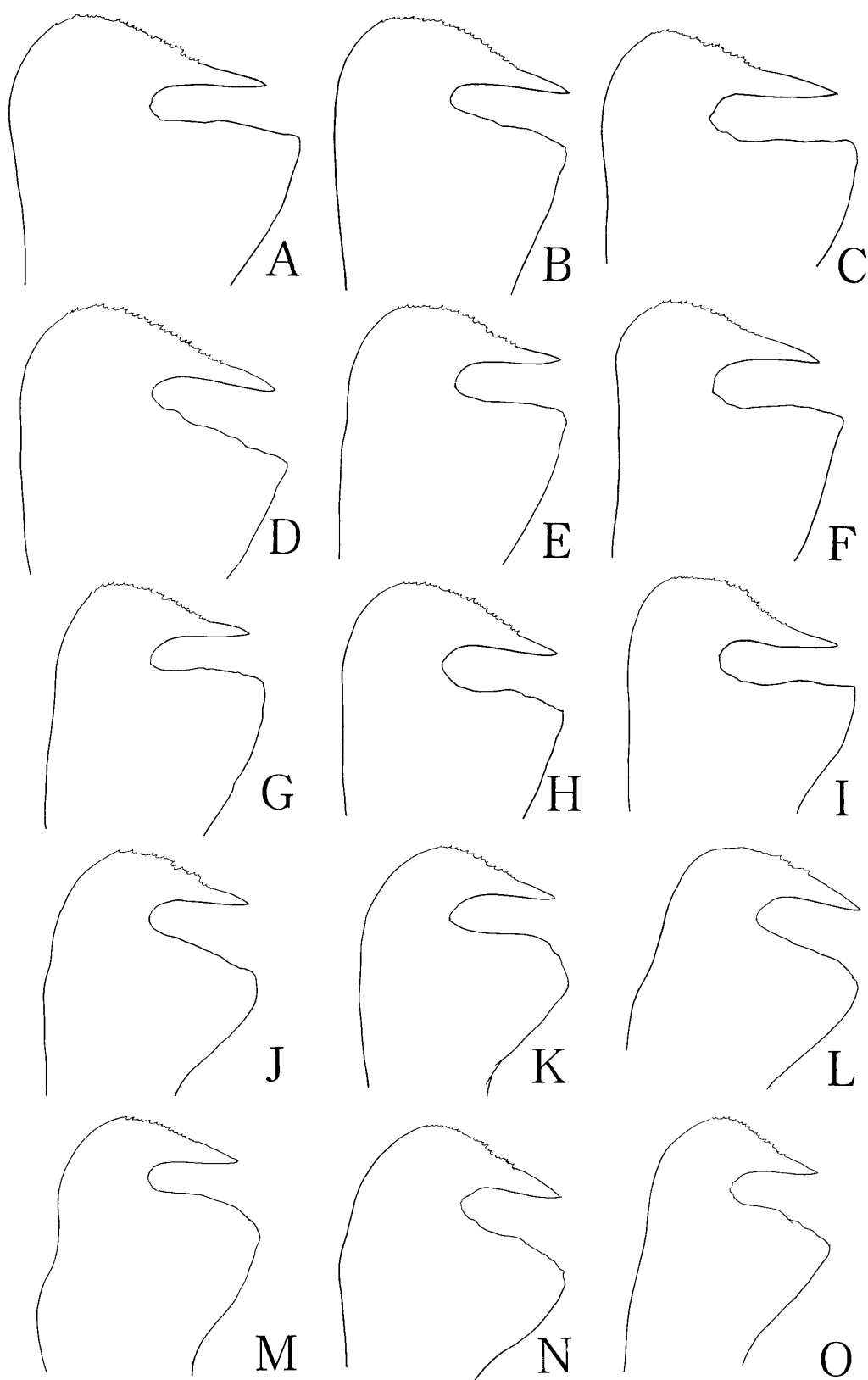
Genitalia. Male: The main feature is represented by that of the *teleius* group and subgroup. The difference from *M. teleius* may be summarized as follows: in *kurentzovi*, band-like lateral sclerite of aedeagus short, slightly longer than the suprazonal portion of aedeagus; valva with dorsal (outer) margin arched, ventral (inner) margin is most expanded at portion somewhat more proximad than in *teleius*, away from the level of the base of distal hook (see Figs 43 and 44J-O), where the margin is bluntly angulate. Female: Ventral sclerite of 6th abdominal segment rectangular, small and short,  $0.57-0.58\times$  as long as lodix. Lodix quadrate, weakly dilated cephalad. Apophysis anterioris indistinct. Cavities of intersternal membrane circular. Genital plate large, caudal half nearly triangular, with a prominent swelling at dorsal base. Ductus bursae broadened at caudal portion. Eighth abdominal venter with rows of long hairs from subventral areas to caudal margin. Papilla analis large and strongly built,  $0.46-0.50\times$  as long as 8th tergum. Apophysis posterioris wide and thick. As for species difference within the *teleius* group, distinct specific characters are seen in the structure around ostium. In dorsal surface of genital plate, a single swelling is present at dorsal base in *kurentzovi*, but in *nausithous* only median ridge is present. In *teleius*, there are two peculiar prominent swellings or protuberances which cover the ostium dorsally. Rows of long hairs at subventral areas of 8th abdominal venter are present in *kurentzovi* and *nausithous*, but absent in *teleius*.

Life history. Unknown.

Distribution. N Korea, southern Primor'e, E and NE parts of China NE (at least Heilongjiang Province), and along Amur River up to China.

In Korea, this species is known mostly from medium altitudes around 1,000 m. Localities of the west and central parts of Korean peninsula as indicated by Mori, Doi & Cho (1934) remain obscure. Biotopes of Haesan Paramtec and Langdak, N Korea, are, according to Dr E. Palik, not uniform: at Langdak, hills are covered partially by brushes with rich vegetation, and at Paramtec, at the altitude higher than Langdak, mountains below peak tops are partially covered by brushes and pine forest. This biotope was dispersed, usually

Fig. 44. Apical portions of left valvae, caudoventral aspects. A-I. *M. teleius euphemia* (Staudinger, 1887). A-C: S Primor'e. A: the same specimen as shown in Fig. 42A. B: as Fig. 42B. C: as Fig. 42C. D-G: N Korea. D: as Fig. 42D. E: as Fig. 42E. F: as Fig. 42F. G: as Fig. 42G. H-I: Europe. H: as Fig. 42H. I: as Fig. 42I. J-O. *M. kurentzovi* sp. nov. J-M: N Korea. J: as Fig. 43A. K: as Fig. 43B. L: as Fig. 43C. M: as Fig. 43D. N: S Primor'e, as Fig. 43E. O: Chita, as Fig. 43F.



situated on small passes; the adults, not plentiful, wandering from one such place to another, apparently together with *M. teleius*, which was rarer there. In Primor'e and inland the species occurs in lowlands. One ♂ from Puksibichan flew in a small area opened for agriculture but then abandoned, surrounded by woodland near a stream. Both *M. teleius* and *M. arionides* were also collected in the same season at the same area. Two ♂ from the inland along Amur River (Junction with Sungari, and Chita) have a very much reduced blue suffusion on dorsal surfaces of wings, but this feature is not unique to them.

Five paratypes were collected on one of the Polish Academy of Sciences expeditions to North Korea (Razowski, 1989). They and specimens in other collections were mixed up mostly with darkish specimens of *M. teleius* usually from the same area.

#### 5. *Maculinea teleius* (Bergsträsser, [1779] 1778-1780)

(Figs 5, 15, 17 adults; 30E map; 31H, I, T-X androconia; 38, 39, 42, 44 male genitalia; 49 female genitalia)

*Papilio teleius* Bergsträsser, [1779] 1778-1780: 71, pl. 43, fig. 4, partim.

*Maculinea teleius*: Verity, 1943: 144; Kawazoë & Wakabayashi, 1976: 115, fig. 18 (androconium), 155-156, pl. 33, figs 3a-1 (♂♂♀♀); Fukuda, *et al.*, 1984: 262-266, pl. 50, figs 1 (♂♀), 2-4 (life history); Yamaguchi, 1988: 22-77, 245-249 (♂♀, life history).

*Maculinea beleius*! Bergstrasse!: D'Abrera, 1993: 484-485, figs (♂♀).

*Papilio euphemus* Hübner, [1800]: pl. Pap. 54, figs 257-259, syn. by Verity (1943).

An extremely variable species both geographically and individually. Many infraspecific taxa have been named, of which still quite a few may be regarded as valid subspecies. For revision, however, comparison must be made on extensive collections from different geographical populations, a condition still premature with the material from the E Asian continent. Only Japanese taxa have been revised in such a way by Fujioka (1975), Kawazoë & Wakabayashi (1976) and Inomata (1982, 1986, 1990).

Life histories have also been worked out in detail with various populations and different subspecies in Japan, first by Fukuda *et al.* (1984) and then by Yamaguchi (1987). Host plants of young larvae are species of *Sanguisorba*, and host ants of older larvae are *Myrmica ruginoides* and *Aphaenogaster japonica*. For records of life history in the continent, see below.

#### A. *Maculinea teleius euphemia* (Staudinger, 1887)

(Figs 15, 17 ♀; 31W androconia; 38, 42A-G, 44A-G male genitalia; 49 female genitalia)

*Lycaena euphemia* Staudinger, 1887: 142, pl. 13, fig. 6 (♀, as *Lycaena euphemus* var. *euphemia*) (Raddefka, Ussuri and Sidemi, Amur, Korea, Peking).

*Maculinea teleius*: Lee, S.-M., 1982: 39, pl. 22, figs 87A-B (♂), C-D (♀), F ([♀]?, as ♂), but not E (Korea);

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Figs 45-50. Female genitalia of the genus *Maculinea*. A. Terminalia, lateral aspect. B. Papilla analis (left), lateral aspect. C. 6th to 8th abdominal venters, ventral aspect. D-F. Ostium bursae. D: ventral aspect. E: dorsal aspect. F: dorsolateral (slightly caudal) aspect. G. Cavities of intersternal membrane, dorsal aspect (aa: apophysis anterioris. ap: apophysis posterioris. cb: corpus bursae. cim: cavities of intersternal membrane. db: ductus bursae. gp: genital plate. pa: papilla analis. vss: ventral sclerite of 6th abdominal segment).

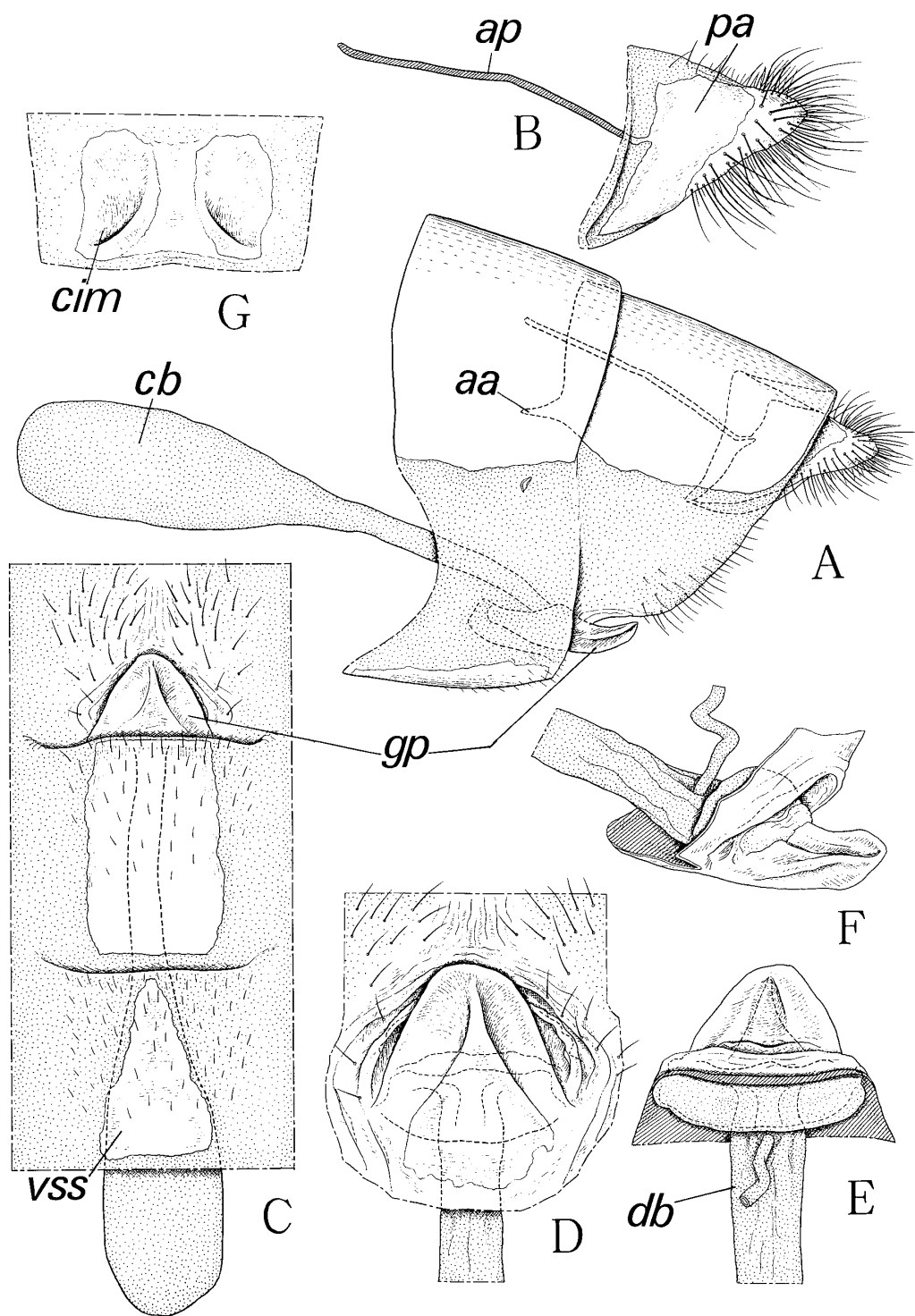


Fig. 45. *M. alcon alcon* ([Denis & Schifferüller], 1775), Poland, Kraków, Tyniec, 26. vii. 1989 (Palik), AS.

- Park, 1987 : 95-97 (N Korea, life history) ; Shin, 1990 : 171, figs 71a-b (♂), c-d (♀) (S Korea) ; Shin, 1991 : 90, 249, figs (♂ ♀) ; Lee, S.-M., 1993 : 23 (Manchuria), partim.
- Maculinea teleius* Druce! : Wang, *et al.*, 1990 : 48 (China : Henan Province).
- Maculinea teleius melancholica* Bryk, 1946 : 58. Syn. by Inomata (1982).
- Lycaena euphemus euphemus* : Kurentzov, 1970 : 141 (Primor'e and along Amur River).
- Lycaena euphemus coreana* Matsumura, 1926 : 30, pl. 2, fig. 5, praecoccupied by *Lycaena coreana* Tutt, 1909 ; Mori, Doi & Cho, 1934 : 51-52, pl. 26, fig. 1 (♂) ; Bollow, 1931 : 292 ; Inomata, 1982 : ix.
- Lycaena euphemia chosensis* Matsumura, 1927a : 161. Syn. by Inomata (1982).
- Lycaena euphemus insignis* Sheljuzhko, 1928 : 51 (Manchuria : Pograditsinaya) ; Kurentzov, 1970 : 142, pl. 14, fig. 25 (♀) (W Primor'e). **Syn. nov.**
- Lycaena hozanensis* Matsumura, 1927a : 168-169, pl. 5, fig. 10 (♀) (N Korea : Pungsan 豊山). Syn. by Inomata (1982).
- Lycaena euphemus hozanensis* : Kurentzov, 1970 : 142 (N Korea : Paekdusan [= Hakutōsan 白頭山]).
- Lycaena arcas* : Seok, 1936 : 273, pl. 18, fig. 3 (♂) (N Korea : Hamgyongbuk-Do [咸鏡北道], Shinasan [新阿山]), nec Rottemburg, 1779.
- Plebejus arcas* : Seok & Asahina, 1940 : 164 (♀) (N Korea : Ryanggang-Do, Poch'ombo [Hutenhō 普天堡]), probably nec Rottemburg, 1779.
- Glaucopsyche arcas* Rottemburgh! : Seok, 1973 : 276-277, nec Rottemburg, 1779.
- Lycaena arion ussuriensis* : Kurentzov, 1970 : pl. 14, figs 23 (♂), 24 (♀) (no remarks on distribution), nec Sheljuzhko, 1928.

Material examined. RUSSIA—Primor'e : ca 35 km W of Chernyshevka, Sinin Range 250-450 m alt., 1 ♀, 24. vii. 1990 (Sibatani) ; Khasanskij River near Korean border, 1 ♂ 20. viii. 1988 (M. Nebaikin), all AS ; 30 km SW of Krounovka and 50 km SW of Ussurisk, 140 m alt., 2 ♂ 29. vii. 1990 (T. Saigusa), KUB ; ca. 85 km SW of Vladivostok, Cape Gamov, Andreyevka 150-200 m alt., 6 ♂ 4 ♀, 1. viii. 1990 (Saigusa & Sibatani), KUB & AS. CHINA —NE : Pinchang [= 賓江, now Heilongjiang Province, Songhua-Jiang 松花江 = Sungary] Prov., Yablonya, 1 ♂, 31. vii. 1940 (M. Nikitin), AS. KOREA—Hamgyongbuk-Do, 咸鏡北道, Mosanrei [Musanryong 茂山嶺], 1 ♂, 27. vii. 1935 (K. Takeuchi), UOP ; Ryanggang-Do 兩江道, Mupo (north of Taechongdan) 1,600 m, 4 ♂, 5-7. vii. 1985 (J. Kozieliec & E. Palik) ; Taechongdan, 1 ♂, 8. viii. 1989 (J. Kozieliec), Hyesan-Paramtec 1,200 m, 1 ♀, 30. vii. 1989, Hyesan-Langdak 900 m, 1 ♂ 1 ♀, 30-31. vii. 1989 (E. Palik), all ISEZ.

FL. ♂♂ 15.5, 18.5, 20.0-24.8 mm, ♀♀ 17.0-17.5, 20.0-23.5 mm.

Colour of the dorsal wings ranges in both sexes from completely dark brown to extensively blue. At this time it is still difficult to define the subspecific character to distinguish them from other known subspecies because of the great variability, both geographic and individual.

Androconia. Broad, distally not roundish, with more ribs than most taxa of the genus. Frequency may be very low in dark brown forms, but they are moderately frequent in bluish specimens.

Genitalia. Male : On top of the feature of *teleius* subgroup, the specific difference from *kurentzovi* consists in the following points : band-like lateral sclerite of aedeagus longer than 2× length of suprazonal portion of aedeagus ; valva with dorsal (outer) margin almost straight, ventral (inner) margin most expanded near the level of base of distal hook, there the ventral margin almost right-angled. Female : Ventral sclerite of 6th abdominal segment small and semicircular, 0.59× the length of lodix. Lodix rectangular, weakly dilated caudally, widest at cephalic 1/4. Apophysis anterioris indistinct or absent. Cavities of intersternal membrane narrowly grooved, inner ridge distinctly concave.



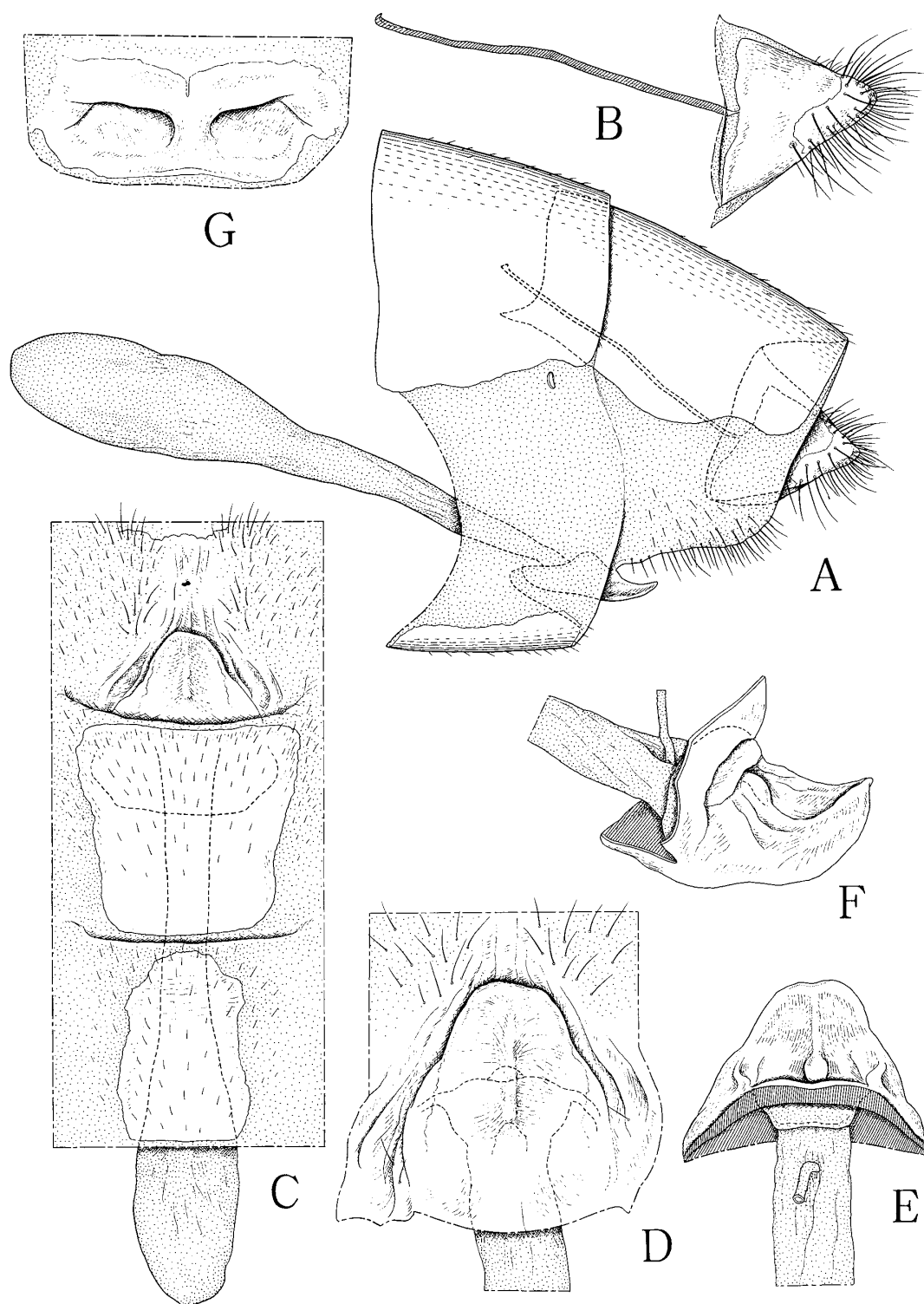


Fig. 46. *M. arion ussuriensis* (Sheljuzhko, 1928), NE Korea, Hoeryong, 22. vii. 1930 (Sugitani), IS.

Genital plate circular, with two prominent swellings covering ostium dorsally; ventral surface uneven, with submedian ridges. Ductus bursae somewhat broadened at caudal portion. Eighth abdominal venter scarcely haired. Papilla analis large and strongly built,  $0.48\text{--}0.53\times$  as long as 8th tergum. Apophysis posterioris wide and thick, gently curved at the middle.

Seok (1936, 1973) and Seok & Asahina (1940) reported *Lycaena* (or *Glaucopsyche*) *arcas* Rottemburg = *M. nausithous* (Bergsträsser, [1779] 1778–1780), from N Korea, but the figure of a ♂ (Seok 1936: pl. 18, fig. 3) is nothing but a ventrally weakly marked specimen of *teleius*, which is rather similar to a ♂ specimen from N Korea (Fig. 15) with weakly developed subterminal series of spots on the underside of wings. The arrangement of the postmedian spots on the underside of wings of these specimens is typical of *teleius* (Fig. 29B), especially the position of the spot  $R_5\text{--}M_1$  on the FW, which is in line with the two spots below, whereas in *nausithous* it is shifted much proximad so that not in line with the ones below (*cf.* Fig. 29D). Without any further positive evidence, we consider that *M. nausithous* has never been reliably recorded from the E Palaearctic Region.

Life history. The early stages and its association with ants have been worked out in N Korea by Park (1987).

Distribution. Continental E Asia, including Amur River continuous from “Transbaikalia” (or east side of Lake Baikal) and Primor’e of Russia, Korea, and eastern part of China NE and also Beijing, as well as Henan Province (Jiyuan 济源 and Lingbao 灵宝), apparently above 1,000 m along the Huang He 黄河 in Henan 河南 Province

The names so far given to the populations on the East Asian continent seem to simply represent various degrees of variations which can occur within one and the same population at a given locality. However, there seem to be some systematic differences to be detected between them and the subspecies known from the islands of the Japanese Archipelago, subsp. *ogumae*, in particular. This may consist of the tendency in the continental specimens of the postmedian spots on the ventral surface being often very much enlarged and strongly marked (Fig. 17), and especially of the spot in  $CuA_1\text{--}CuA_2$  of the FW not being shifted based but more perfectly in line with those in  $M_3\text{--}CuA_1$  and  $CuA_2\text{--}1A + 2A$  (Fig. 29B). These characters can also be seen in figs 23 and 24 of Kurentzov (1970) as wrongly illustrated as *Maculinea arion ussuriensis* (Sheljuzhko).

Populations occurring further inland were called by Kurentzov (1970) as subsp. *splendens* (Kozhanchikov, 1924) originally described as an aberration of the genus *Lycaena*; preoccupied by *Lycaena splendens* (Staudinger, 1881), named as *Polyommatus*, from upper Amur (*e.g.*, Shilka) River. How distinct they are from those near the Pacific coast will need redefining. The same applies to *obscurata* (Staudinger, 1892) recently listed by Bálint (1989a, 1990) from Mongolia according to the preceding literature available to him.

#### B. *Maculinea teleius sinalcon* Murayama, 1992, **stat. nov.**

(Figs 5 holotype ♂; 31H, I, androconia; 39 male genitalia)

*Maculinea sinalcon* Murayama, 1992: 37 (Huanzhou =? Huangzhong 湟中, Qinghai); D’Abrera, 1993: 484–485, figs (holotype).

Type. Holotype, ♂. CHINA—Qinghai Province: Huanzhou (examined).

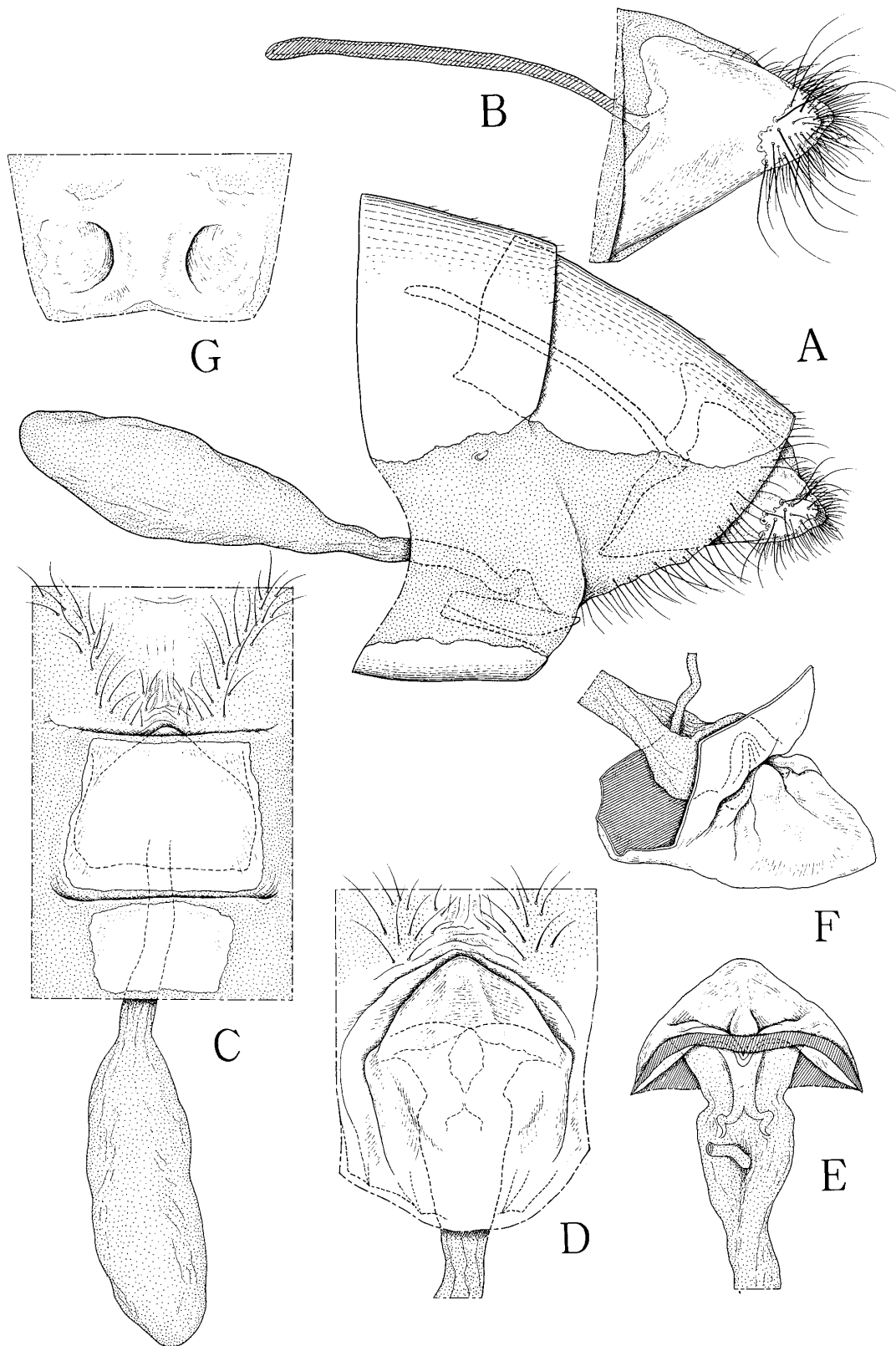


Fig. 47. *M. arionides takamukai* (Matsumura, 1919), Japan, Nagano-ken, Kamikoti, 15. viii. 1936 (Takeuchi), UOP.

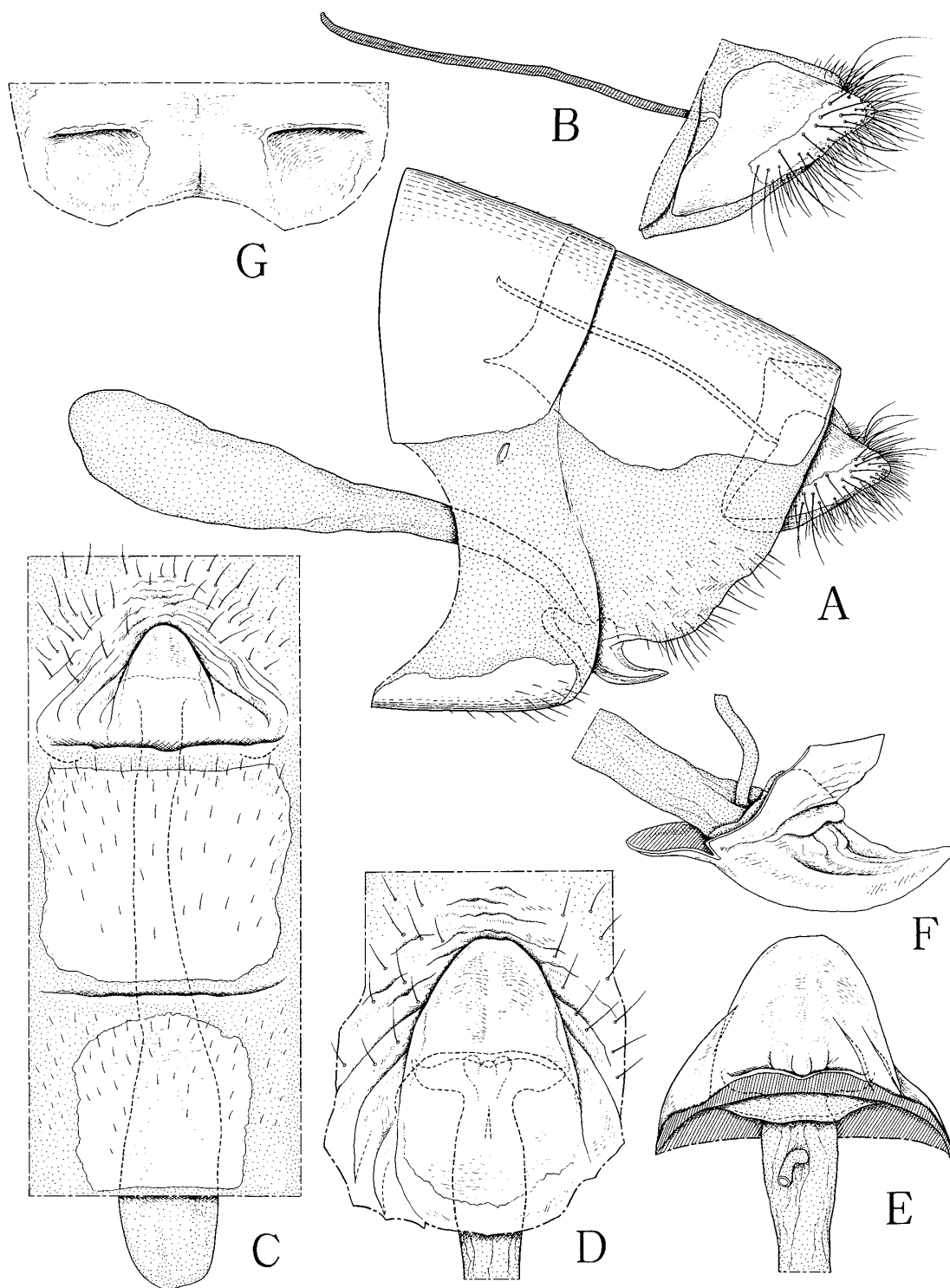


Fig. 48. *M. kurentzovi* sp. nov., Primor'e, Ternei, 3. vii. 1964 (Volkava), IBP.

Other material examined: CHINA—Qinghai Province: Taer Monastery near Huangzhong, 2 ♂ 1 ♀, 19. vii. 1992 (Y. Watanabe), KS.

This taxon was originally described as an independent species by Murayama (1992) based on a single specimen. It is apparently sympatric with *M. arion inferna* nom. nov. at its type locality of east Qinghai. We have before us three additional specimens apparently from the same area as the type locality of eastern Qinghai where they were collected along with *M. arion inferna*.

Because the male genitalia of the *sinalcon* holotype are indistinguishable from those of *M. teleius euphemia*, and also because the existence of an intermediate form to the ordinary patterning of *teleius* from that of the holotype, we wish to treat this taxon as the west Chinese subspecies of *teleius*. To our knowledge, the species *teleius* has not been recorded from this part of China.

FL. ♂♂ 16.0–18.5 mm, ♀ 21.5 mm

♂. Dorsal surface almost entirely dark brown, with occasional blue streaky suffusion in cell and  $CuA_2-1A+2A$  on FW and more diffuse suffusion on proximal HW; pale grey longitudinal band distad of postmedian line is discernible in some specimens especially on FW. Ventral surface in shade (in holotype it is pale grey brown). Ventral surface postmedian spots are rather like in *M.alcon*, postmedian spot in  $CuA_1-CuA_2$  on both wings shifted basad in accordance of the general patterning of *Maculinea*. Fringes white.

♀. Dorsal blue suffusion is hardly discernible. Ventral surface slightly yellowish brown with patterning characteristic of ♂ less pronounced. Fringes brown.

Androconia. Moderately frequent as in *arirang* and *nausithous*, despite the almost complete absence of blue scales; the shape is similar to that of *xiaheana* but the rib may be slightly more numerous (Tables 1 and 2); thus they are quite distinct from those of *M. teleius euphemia* to the dark form of which the butterfly looks rather similar.

Genitalia. Male: Essentially similar to those of *teleius euphemia* and other subspecies (cf. Figs 38 & 39). The unusual form of the socius and other dorsal portions of holotype as figured by Murayama (1992) seems to be due to the unusual angle from which the organ was observed. Unfortunately the dorsal half of the genitalia of the holotype has been lost since the original description, but we have dared to consider the above interpretation likely by observing the male genitalia of *Maculinea teleius* from various angles.

Life history. Completely unknown.

Habitat where specimens were collected at Kumbun Monastery was described by Watanabe (1993) and summarized in the section of *M. arion inferna* above.

### C. *Maculinea teleius daisensis* (Matsumura, 1926)

*Lycaena euphemus daisensis* Matsumura, 1926: 27, pl. 2, fig. 8 (♀) (Tottori-ken: Mt. Daisen).

*Maculinea teleius daisensis*: Inomata, 1985: 265–266, figs 39–76 (♂♂ ♀♀); Inomata, 1990: 112, figs 932–934 (♂♂ ♀♀).

*Maculinea teleius kazamoto*: Fujioka, 1975: 143–148, pl. 74, figs 31–89 (♂♂ ♀♀), partim nec H. Druce, 1875.

Materials examined. JAPAN—Honsyû, Tottori-ken, Daisen, 3 ♂ 2 ♀, 5. viii. 1960 (O. Yata), 1 ♂, 13. viii. 1959, KUB; Okayama-ken, Asidati, 2 ♂, 13. viii. 1959, KUB. Kyûsyû,

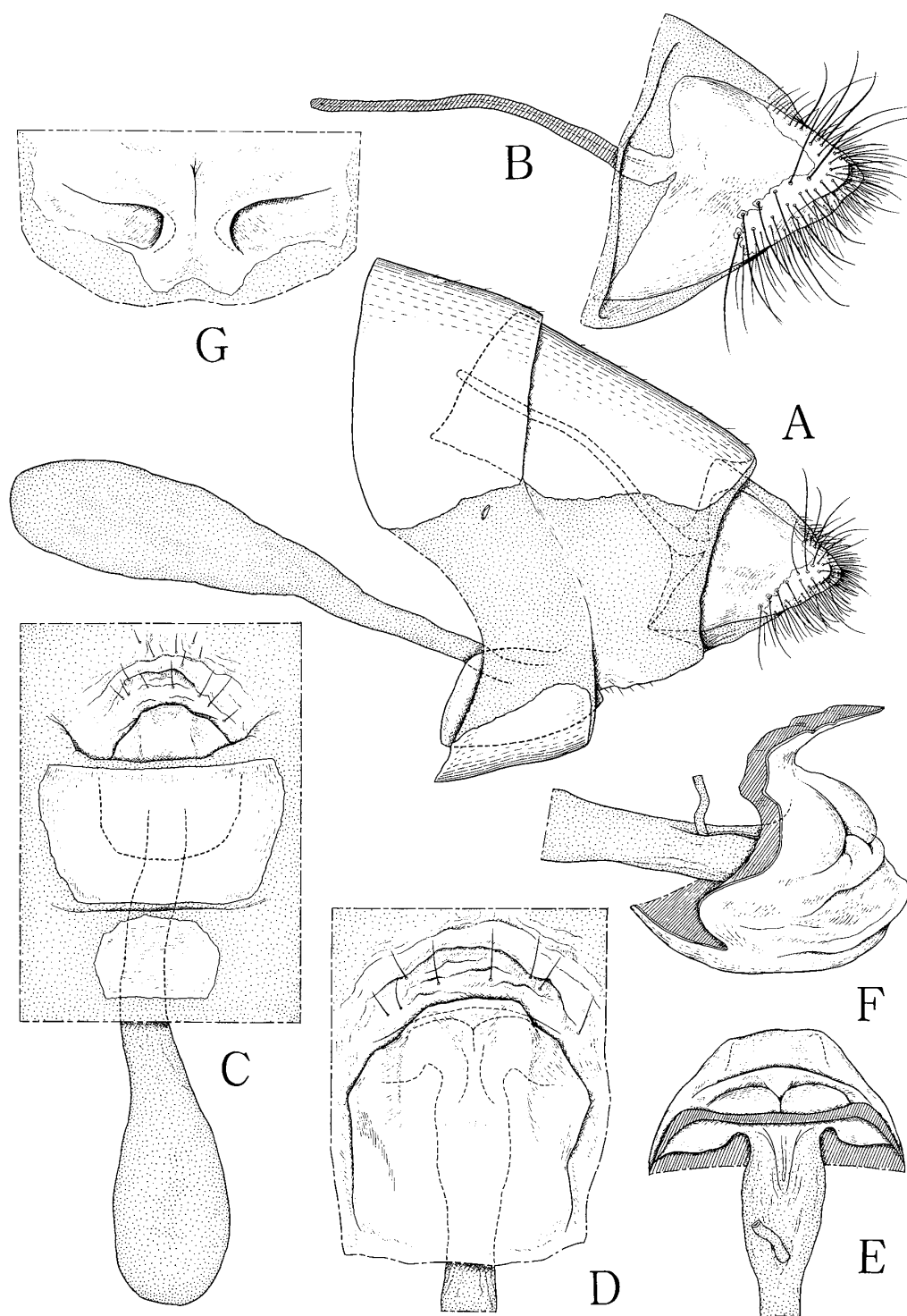


Fig. 49. *M. teleius euphemia* (Staudinger, 1887), Primor'e, Sinin Range, 24. vii. 1990 (Sibatani), AS.

Kumamoto-ken, Mt. Aso, Okamadoyama, 2 ♂ 3 ♀, 11. viii. 1969, Suziyu-Hattyô-baru, 1 ♂ 1 ♀, 11. viii. 1966 (T. Shirôzu), KUB.

FL. ♂♂ 16.0 mm, 20.0–23.0 mm, ♀♀ 18.2–23.0 mm.

The blue colour dominates with strongly marked spots on the dorsal surface of the wings, and proximal submarginal spots take triangular form on the ventral surface. See Inomata (1986, 1990) for alternative schemes of finer subspecific classification and their cognate synonyms, many of which are listed by Bollow (1930).

Distribution. W Honsyû and N Kyûsyû.

#### D. *Maculinea teleius hosonoi* Takahashi, 1973

*Maculinea teleius hosonoi* Takahashi, 1973: 80, figs 3A–C, 4A–B, 5A–C (♂♂), 3D, 4C–D, 5D (♀♀) (Nagano-ken: Mt. Karamatu, Niigata-ken: Mt. Asahi, Gihu-ken: Mt. Dainiti); Fujioka, 1975: 143–148, pl. 73, figs 31–52, 64 (♂♂ ♀♀); Inomata, 1985: 265–266, figs 1–24 (♂♂ ♀♀); Inomata, 1990: 112. *Maculinea teleius hakusanensis* Fujioka, 1975: 143–144, pl. 73, figs 53–63 (♂♂ ♀♀) (Gihu-ken: Mt. Dainiti), implicated but not synonymized by Inomata (1990).

Material examined. JAPAN—Nagano-ken, Hakubayari, Hakuba, 2 ♂, 8. viii. 1965 (E. Hama); Niigata-ken, Itoigawa, Mt. Sirokutizawa, 1,700 m. alt., 1 ♂, 31. vii. 1978 (T. Mizobe), KUB.

FL. ♂♂ 15.0–18.0 mm.

Small and blue colours not developed well in ♂, and especially in ♀. Ventral surface darker than in subsp. *kazamoto* (Druce).

Distribution. Central highlands of Honsyû.

#### E. *Muculinea teleius kazamoto* (H. Druce, 1875)

(Fig. 31X androconium)

*Lycaena kazamoto* H. Druce, 1875: 361 (Yokohama, probably implying Central Japan).

*Maculinea teleius kazamoto*: Fujioka, 1975: 143–148, pls 71, 72, 73, figs 1–30, 65–115, pl. 74, figs 1–50, 91–110 (♂♂ ♀♀), partim; Inomata, 1985: 263–264, pl. 49, figs 25–104, pl. 50, figs 1–38, 77–96 (♂♂ ♀♀); Inomata, 1990: 112, figs 929–931, 935–937 (♂♂ ♀♀).

Materials examined. JAPAN—Nagano-ken, Nagawa Huruzuyuku, 2 ♂ 1 ♀, 21. viii. 1987 (A. Sibatani), AS; Ina, 4 ♂ 4 ♀, 3–11. viii. 1952 (Nakajo), KUB; Gihu-ken, Takayama, 2 ♀, 19. viii. 1972 (S. Nishida), KUB.

FL. ♂♂ 16.5, 19.2–22.0 mm, ♀♀ 21.0–23.5 mm.

One of the most variable subspecies, ranging in both sexes from completely dark form to that with extended blue ground colour on the dorsal surface.

Androconia. Frequency in a blue form was low as in *ogumae* or *teleius* of Europe and morphology is similar to that of *euphemia*.

Distribution. Central Honsyû.

#### F. *Maculinea teleius ogumae* (Matsumura, 1910)

(Fig. 31V androconium)

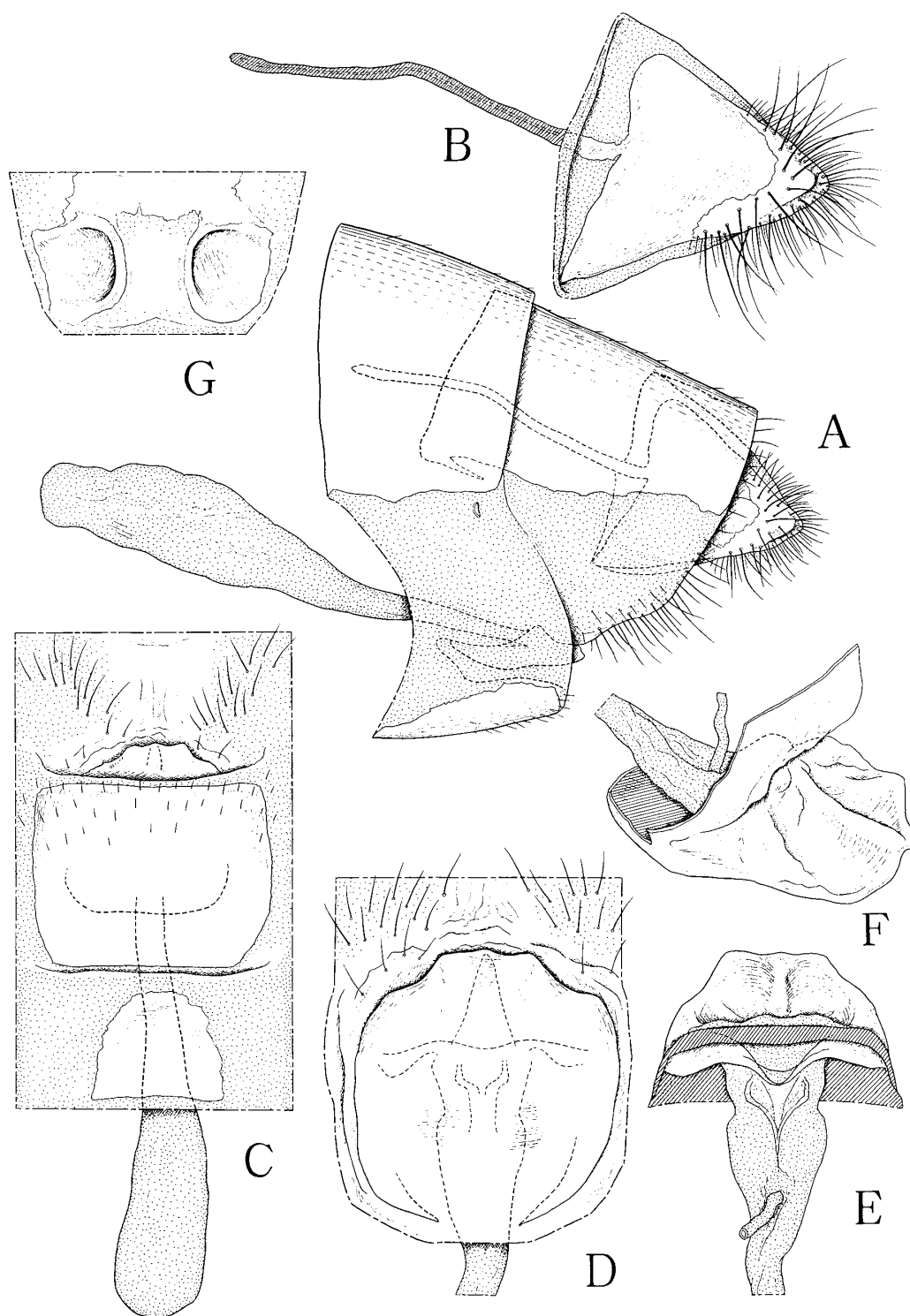


Fig. 50. *M. nausithous* (Bergsträsser, [1779] 1778-1780), Poland, Kraków, Tyniec, 27. vii. 1991 (Palik), AS.



*Lycaena euphemus*, var. *ogumae* Matsumura, 1910 : 221 (Sakhalin).

*Maculinea teleius ogumae* : Fujioka, 1975 : 143-148, pl. 70 (♂♂ ♀♀); Inomata, 1985 : 263-264, pl. 48 (♂♂ ♀♀); Inomata, 1990 : 112, figs 923-928 (♂♂ ♀♀).

Many referred to other subspecific names : Inomata, 1985.

Material examined. RUSSIA—Sakhalin (former Karahuto, JAPAN) : Sakaehama, 1 ♂ 1 ♀, 28. vii. 1929; Konuma, 1 ♂ 1 ♀, 4. viii. 1929; Toyohara, 2 ♂, 17, 20. vii. 1922 (I. Sugitani); locality unknown, 1 ♂, 10. vii. 1921, all IS. JAPAN—Hokkaido, Masyû-ko, 3 ♂, 5-6. viii. 1938 (K. Hayashi), KUB & UOP; Kitami, Simoyûbetu, 2 ♂, 10. viii. 1924 (K. Kobayashi); Obihiro, 7 ♂ 1 ♀, 9. viii. 1953 (H. Ono), KUB; Kôsin, 1 ♂ 1 ♀, 25. vii. 1969 (Aoki), AS. Honsyû, Aomori-ken, Iwaki-san, 12 ♂ 1 ♀, viii. 1948 (K. Saito), KUB.

FL. ♂♂ 16.2-21.0 mm, ♀♀ 17.3-21.0 mm.

Always blue on the dorsal surface, the northern populations are smaller and with lighter blue and narrow black margin on the dorsal surface. Spot in  $CuA_1-CuA_2$  on the ventral surface of both wings approaches the position typical of *Maculinea* rather than representing the exceptional one common to all the other subspecies except for *sinalcon*.

Androconia. Morphology (Table 2) and frequency (Table 1) are both basically similar to other E Palaearctic subspecies, whereas those of *teleius teleius* from Europe may be somewhat different (Fig. 31 T-U).

Genitalia. Female : essentially similar to those of *euphemia* (Staudinger).

Distribution. Sakhalin, Hokkaido including southern Kurile Islands, and N Honsyû.

## Addendum

***Maculinea nausithous*** (Bergsträsser, [1779] 1778-1780)

(Figs 31G androconium; 41 male genitalia; 50 female genitalia)

*Papilio arcas* Rottemburg, 1779 : 25 (praeocc. by *Papilio arcas* Drury, [1773]).

*Papilio nausithous* Bergsträsser, [1779] 1778-1780 : 70.

Material examined : Many ♂♂ ♀♀ from various parts of Europe, including Slovakia and Poland.

FL. ♂♂ 13.0-18.0 mm, ♀♀ 14.0-19.5 mm.

Androconia. Moderately abundant (Table 1); dark, shape being characteristic, narrow but looks "truncate" with straight distal edge, suggesting a transition to *teleius*; ribs less numerous than most other species of the genus (Table 2).

Genitalia. Male : Characterized by the description of the ♂♀ *nausithous* subgroup of the *teleius* group (p. 14). Female : Ventral sclerite of 6th abdominal segment small and semi-circular,  $0.57-0.59\times$  as long as lodix. Lodix quadrate. Apophysis anterioris absent. Cavities of intersternal membrane circular. Genital plate large and circular, posterior half trapezoidal, with dorsal median ridge; ventral surface uneven. Ductus bursae broadened at caudal portion. Eighth abdominal venter long haired as in *kurentzovi*. Papilla analis large and strongly built,  $0.50-0.54\times$  as long as 8th tergum. Apophysis posterioris wide and thick, gently curved at middle as in *teleius*.

Distribution. Continental Europe west of the Urals. Unknown from Asia.

The two records of *nausithous* from northern part of Korea (Seok, 1936; Seok & Asahina, 1940) are based at least partially on misidentification of *M. teleius* devoid of the series of submarginal spots. The only photograph of a ♂ (Seok, 1936: pl. 18, fig. 3) clearly shows the arrangement of postmedian spots on the ventral wings typical of *teleius* (cf. Fig. 29B). Another specimen of *M. teleius* from N Korea showing a similar patterning is illustrated in Fig. 15. Moreover, here and also in the figure of Seok (1936), the spot of ventral FW in  $R_5-M_1$  is nearly in line with two other spots beneath in space  $M_1-M_3$ , whereas in *nausithous* the former spot is much shifted basad (Fig. 29D). See also *M. teleius euphemia* (p. 202-206).

## Discussion

So far, with 5 species and well-investigated early stages including their intricate relationship with ants, the continental Europe has been regarded as the headquarter of the genus *Maculinea* in the Palaearctic Region. However, we have shown here that continental "Far East" Asia is as rich as, or possibly even richer than, Europe in the diversity of *Maculinea* species. The uncertainty concerning the sibling species *alcon/rebeli* aside, there occur at least five species, three of which are common with Europe, the remaining two being endemic to East Asia, and eventually one more independent species which has been treated here as high altitude subspecies, *arirang* nov., of the lowland species common with Europe, *M. alcon*.

Of this total of five species with a few additional significant subspecies in the "Far East" Asia, three (*arion*, *arionides*, *teleius*) have been rather well documented (see Fig. 30 for distribution maps). Of the remaining two plus some subspecies, only a few specimens have so far been known of *alcon*, *arirang*, *xiaheana* and *sinalcon*. *M. alcon arirang* has now been recognized as a well-definable taxon from northern Korea, where a fairly extensive search of butterflies were made, during the thirties under occupation by Japan, by both the native Koreans and the expatriate Japanese. Yielding only a few specimens of this taxon as far as we are aware, of which only two we have been able to examine. By contrast, occurrence of the so far unrecognized species *kurentzovi* sp. nov. was first noticed by Mori, Doi & Cho (1934), but, buried among specimens of the related species *teleius*, specimens of this species have found their ways to various collections. However, nobody has collected this taxon consciously as an independent species in the field, and we know very little of its biology. A single specimen which one of us (AS) collected in Primor'e was found in a small grassy open area at the foot of a slope covered by secondary growth of *Quercus mongolica*. The area was a few hundred meter away from the more woody spots where *M. arionides* flew. Although a few specimens of *M. teleius* were collected here along with the single specimen of *kurentzovi*, it is not clear whether both species flew really side by side. Still, this seems to be quite likely in the habitat of northern Korea where E. Palik collected *kurentzovi*, although here *teleius* seems to be fairly scarce.

The task before us now is to find out (1) the real status of these little known taxa in E Asia, and (2) to elucidate the early stages and the mode of their association with ants for local populations of *arion* in the continent, *arionides* and *teleius*. Such pieces of information would help uncover the degree of variation in the mode of association with ants in these three rather well-known species. Elucidation of the early stage of *kurentzovi* would not be too difficult in the near future at one or more well-established localities in N Korea and Primor'e. Eventually, it would not be too difficult to uncover the life history of *M. alcon arirang* at Taechongdan, N Korea. Such a body of new findings will certainly help us to

redefine the strategies of butterfly conservation in the eastern part of the Asian continent as well as in Japan, while being fully benefited by the accumulated experience and knowledge in Europe with the related *Maculinea* taxa<sup>3</sup>.

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<sup>3</sup> The fact that E Asia is richer in biodiversity of *Maculinea* than Europe may contribute to preventing certain degrees of Eurocentrism in legislation for Nature Conservation in at least some European countries.

The rigid, almost prohibitory policy being taken by the People's Republic of China on the collection and export of Chinese insects has continued to be serious obstacles for bringing the knowledge of Chinese *Maculinea* taxa to the level in the rest of the E Palaearctic Region. Unlike with professional and amateur lepidopterists of many Eurasian countries as mentioned in this paper, the declarations of the willingness to help and cooperate by the Chinese entomologists and also the statement on the likelihood of existing rules being relaxed for more efficient collaboration with international taxonomists for investigating the *in situ* and *ex situ* specimens of Chinese *Maculinea* have (at least) so far proven to be nearly vacuous. Although we do understand the difficulties under which our Chinese colleagues are placed at the moment, the procedures witnessed and experienced by international bodies of entomologists with Chinese lepidopterists (for example, see Sibatani, 1991) seem to suggest that our Chinese colleagues may not actually have a good grip on the point as to how scientific research in natural history can be conducted and new findings obtained by activities of seasoned scientists in an unfamiliar field and later in the laboratory, a situation which we hope will now be quickly removed by the enormous improvement of scientific (including entomological) and economic status of China.

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## 摘 要

旧北区東部のゴマシジミ属 (柴谷 篤弘・三枝 豊平・広渡 俊哉)

ゴマシジミ属 *Maculinea* van Eecke, 1915 は旧北区の北よりの温帯地域に産し、ヨーロッパでは古くから4種が知られていたが、最近幼虫期の知見によって5種に区別されるようになった。すなわち、*M. alcon* ([Denis & Schiffermüller], 1775); *M. rebeli* (Hirschke, 1904) (従来 *alcon* と混同され、成虫外部形態ではこれと差がなく、幼生期および共生するアリの種類で区別され、どちらかというとならば標高の高いところから記録されている); *M. arion* (Linnaeus, 1758) ゴウザンゴマシジミ; *M. nausithous* (Bergsträsser, [1779]) (= *arcas* Rottenburg, 1775) および *M. teleius* (Bergsträsser, [1779]) ゴマシジミがそれである。1970年代に *M. arion* がイギリスで最後の唯一の産地で絶滅してから、*Maculinea* 属のチョウはすべて、幼生期に特定のアリの巣に入って肉食となる、というその特異な生活史によってヨーロッパではしばしば最も絶滅の危険の高いグループとされ、自然保護者の関心をあつめて一般の注目をあびてきた。

日本でも *Maculinea* の2種 *M. arionides* (Staudinger, 1887) オオゴマシジミと *M. teleius* (Bergsträsser, [1779]) ゴマシジミはともに幼虫がアリの巣に入ることによって注目されており、近年その生存がおよびやがては絶滅の危険が高いとはされてこなかった。

このたび沿海州で柴谷が採集した1♂が、ゴマシジミに近似しているために、従来大部分はこれと混同されてきた別種であることがわかり、また他にも未記載の類位が朝鮮半島北部に産することがわかったため、ここに東アジア、主として北朝鮮、沿海州、中国東北 (部分的にはモンゴルと中国中西部をも含む) のゴマシジミ属の総説を書くことにした。これは従来この属の♂♀交尾器や発香鱗が系統的に調べられていなかったため、それらの分類学的な価値や意味を検討しておくことが新類位の記載に必要となったためである。以下に東アジア産のゴマシジミ属の分類・分布をまとめておく。

1. *Maculineaalcon* ([Denis et Schiffermüller], 1775)1A. *M.alcon kondakovi* (Kurentzov, 1970), comb. nov.

中国東北, 沿海州, おそらくモンゴル(未検).

きわめて稀. ヨーロッパの原亜種に比べて裏面が淡色である.

1B. *M.alcon arirang* subsp. nov.

朝鮮半島北部, 白頭山南方の山地.

1A よりも標高の高いところでえられている. ひょっとすると独立種かもしれないが, 生活史の解明をまって検討すればよいだろう. 小型で裏面前翅翅頂に近い外横線上の3点が直線上に並び, そのいちばん下のものが外縁に近く位置することに特徴がある.

2. *Maculinea arion* (Linnaeus, 1758) ゴウザンゴマシジミ2A. *M.arion ussuriensis* (Sheljuzhko, 1928).

沿海州 (未検), アムール河上流 (未検), 朝鮮半島北部.

大型, ♀は表面青味をおびず褐色無紋.

2B. *M.arion philidor* (Fruhstorfer, 1915)

モンゴル, 中国甘肅省西北 (祁連山脈東端).

やや小型, ♀に青色部が半ば出ることが多い. 後翅裏面は青緑色の鱗粉がよく発達し, しばしば亜外部に達する. 斑紋は大きくてよく発達している.

2C. *M.arion xiaheana* (Murayama, 1991), stat. nov.

中国甘肅省西部夏河 (約 3,000 m).

♂表面青色はひろく外縁に達するが, 輝きは弱い. 小型のものが多く, 表裏面とも外横紋列は小形化または消失する. 後翅裏面の青緑色は通常強く発達. ♀表面青色部は前翅基半に限られる.

2D. *M.arion inferna* nom. nov.

*Lycaena arion tatsienluica* Oberthür, 1910 (先取りされ無効) の代替名. 旧チベットすなわち現四川省西部, 青海省東部 (2,700 m 付近).

前亜種に似るが, 大型で♂の青色は輝きが強い. ♀では青色部は後翅表面基半よりもやや外側までひろがり, 外横紋列を強くあらわす. ひょっとすると, *xiaheane* の主観的シノニムになるかもしれないが *tatsienluica* のタイプ未見のため今回は暫定的措置にとどめた. 亜種 2B, C, D は Bálint (1990) によって *arion* から離して独立種として扱われた *cyanecula* (Eversmann, 1848) 群にはいる. その特徴は後翅裏面の青緑色がひろがっていることと, 乾燥地帯に生息することである. 甘肅省の産地の記録は農作地帯で, かならずしもこれは乾燥地帯ではないようであるが, 生活史の解明が望まれる.

3. *Maculinea arionides* (Staudinger, 1887)3A. *M.arionides arionides* (Staudinger, 1887)

アムール河中部, 中国東北, 沿海州, 朝鮮半島北部, チベット.

♂のりり色の部分の広い大型の美しい亜種.

3B. *M.arionides takamukui* (Matsumura, 1919)

北海道, 本州.

やや小型で, ♂表面外縁沿いの黒縁の幅が広い.

4. *Maculinea kurentzovi* sp. nov.

チタ, 沿海州, 中国東北, 朝鮮半島北部.

裏面前翅中室内の黒点の並び方, 前翅  $CuA_2-1A+2A$  室の外横線黒斑が大きく印されていることと, 前後翅の  $CuA_1-CuA_2$  室の紋が, 一般の *Maculinea* 各種のように基方にずれていることで, *teleius* から区別される. ♂交尾器も *teleius* 型でよく似ているが, ♂の発香鱗をまったく欠くとい

う顕著な特徴をもつ。

5. *Maculinea teleius* (Bergsträsser, [1779] 1778-1790) ゴマシジミ

5A. *M. teleius euphemia* (Staudinger, 1887)

沿海州, 中国東北, 朝鮮半島, 中国北京, 河南省, それから内陸部にかけてシベリア, モンゴルにも分布するが, 別亜種かもしれない。

表面地色が黒いものから青いものまで変異が多いが, 裏面外横線の黒紋列はときに非常に大きくなる。各地の亜種区別の有無は定かでない。

5B. *M. teleius sinalcon* (Murayama, 1992), stat. nov.

中国青海省東部。

表面♂♀ともに暗色。裏面外横線の紋列はしばしば *Maculinea* の一般的配列に従い  $CuA_1-CuA_2$  の紋が基方にずれるが, 中間型もある。

もともと独立種とされたが♂交尾器の特徴は *teleius* と変わらない。

5C-F. 日本の諸亜種を充当した。

*Maculinea* のアジア大陸産各類似について生活史解明が望まれる。すでに知見のあるのは北朝鮮での *arionides* と *teleius* の記録 (Park, 1987) のみである。

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